SEPTEMBER 13, 1945

American Machinist

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Latin America's Industry

EXPANSION IN METAL-WORKING BOOSTS MACHINE TOOL NEEDS

Heald experience in solving thousands of problems—points the way to your best answer

A method we devised for precision grinding 200 bearing races an hour, is utilized in solving the problem of finishing engine sleeves 6 times faster. Meeting the need for more accurate production in Detroit points the way to faster production for a customer in Toledo. And so it goes . . .

The point is—in meeting an endless variety of precision finishing problems, Heald has built up a wealth of "know-how" upon which you can draw. In the Heald vaults are literally tens of thousands of case histories—including ingenious methods of tooling, holding work, utilizing indexing fixtures and cross-slides—one or more of which can be engineered into a machine to finish *your* parts faster and at less cost.

Now, before you get embroiled in the fast approaching hectic competitive battles, why not price-mark your production for waiting peace-time markets. Scrutinize operations in your plant in the light of what Heald Precisioneering can help you achieve. A Heald Engineer will be glad to work along with you.

THE HEALD MACHINE COMPANY
WORCESTER 6, MASS.

More Precision · Less Cost **HEALD**

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

American Machinist

September 13, 1945

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CHANGE OF ADDRESS

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★ New Title or Position _____

American Machinist Chips

In This Issue . . . The lead article is based on a survey of Latin America's industrial expansion plans. The survey reveals a large pent-up demand there for machine tools. Results are supported by statements from individual Latin American industrialists and give concrete proof that the demand for machine tools will be great.

Those in the throes of reconversion will be interested in the story featuring Pontiac Motor's neat transition from wartime to peacetime production without interrupting operation.

A seven-page article by Allen Candee of the Gleason Works will prove of value to men interested in gear problems. The article presents tables of factors which enable the solution of problems involving involute spur gears where designers wish to change tooth thickness or center distances. The tables avoid the need of series of difficult calculations.

A special eight-page article on Atomic Power, prepared by McGraw-Hill editors, we recommend to all as worthwhile reading.

Pattern for Power . . . Some of us may be inclined to forget occasionally that a vital part of the Metal-Working Industry is played by pattern departments, in which master craftsmen work almost entirely on wood.

One such is the Model Shop at Wright Aeronautical, interestingly described in a recent issue of their publication *Trade Winds.*

Building a Cyclone engine from metal on precision machines is no mean job; building one out of wood—cylinder heads, crank cases, carburetors and even tubing in varieties of complex bends—is something to marvel at.

For engine builders, the Model Shop provides an exact stand-in for the finished product. Every part fits perfectly.

1945 Inventory . . . You may be interested in knowing that our 1945 Inventory of Metal-Working Equipment, which appeared in the July 5 issue, has received an Honorable Mention in a nation-wide contest among business papers for the best research published during the past year. We are happy to have this recognition of a study which we feel will be of great value to you and our industry.

Incidentally, more letters have been coming in commenting on the Inventory. . . . including the following:

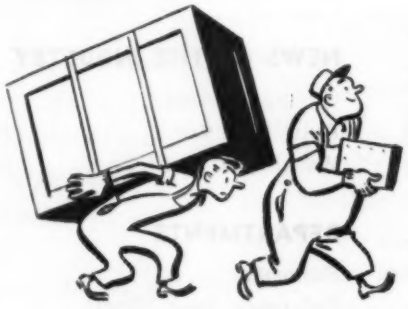
"Mr. Maverick has asked me to express to you his appreciation of your courtesy in sending him the 1945 Inventory. I am turning it over to the Director of our Surplus Property Division who, I believe, will find it a valuable help."

J. K. Weddell, Deputy Chief, Operations Bureau, Smaller War Plants Corp.

"I am glad that you decided to go ahead with this project and I believe it is an outstanding service to all branches of industry, tool-using and otherwise."

R. E. W. Harrison, Chambersburg Engineering Co.

Correction . . . In this column, July 19 issue, we mentioned an extremely worthwhile book called "Wartime Technological Developments." We said you could get copies of this from the Senate Subcommittee on War Mobilization. We are advised, however, that their supply is exhausted but that copies may still be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. at fifty cents per.



Moving Day? . . . Now that large-scale reconversion is actually here, it is to be expected that many of our readers will be shifting around to different plants. This involves, of course, a change of address for such men. So that we can keep *American Machinist* coming to you regularly in this important change-over period, we ask you to notify our Circulation Department promptly if-as-and-when you move. It will help you and us.

Long Time No See . . . Every so often we run across examples of unusual readership on the part of our subscribers. However, we are indebted to Nicholson File Company, of Providence, for an item which seems to take the cake . . . at least within our memory. In a letter from a friend in Sweden, they received a request for a copy of a piece of Nicholson literature, *File Filosophy* . . . as advertised in *American Machinist* . . . not last month, not last year, not just before the war, *but in the March 2, 1912 issue, page 93!* We always said *American Machinist* was of lasting value to our readers, so here you are. Happens every day . . . we wished!

Veteran Schooling . . . With more and more men coming back to take up their jobs, Metal-Working executives face the problem of gearing these men into today's and tomorrow's manufacturing set-ups. Although many veterans have had intensive technical training while in the service, and may have been skilled before they left, they cannot be expected to be completely up-to-date on the extensive developments in this field during the war years.

Each plant, of course, will have its own program. However, we want to remind you that rehired veterans may find, in your files of *American Machinist* back copies, a wealth of information on developments as they have occurred. This, naturally, goes also for current and future issues.

In addition, we have a wide variety of reprints featuring special sections which have appeared in our papers. These include working of various types of materials; fundamental training data for green employees; sections devoted to the use of small tools; articles featuring present and future metal-working practices in heat-treating, inspection, welding, etc.; articles dealing with reconversion problems.

Our stocks of these are varied and fairly limited. However, if you think you can use such literature in getting returning veterans squared away, write *Chips Editor, American Machinist,* and we will see what we can do.

WHAT DO YOU NEED IN A CLUTCH OR COUPLING?

. . . . . PRECISION?

. . . . LOAD CAPACITY?

. . FAST PRODUCTION?

GLEASON CURVIC* COUPLINGS give you all 3

GLEASON CURVIC COUPLINGS join permanently in perfect alignment the three members of a built-up crankshaft for a two-throw radial aircraft engine.

A precision connection of a new type is now available for use in permanent couplings and releasing couplings (clutches). These couplings have teeth of radial direction and parallel depth, cut and ground into the faces of the connected parts.

Gleason Curvic Couplings are produced on the same Gleason cutting and grinding machines used for curved-tooth bevel gears . . . hence, they have the same high degree of accuracy and fast rate of production.

The Curvic design provides a precision, light, compact, and self-contained connection in which the teeth both center and drive. The accuracy and uniformity are such that complete interchangeability is possible, facilitating manufacture and assembly of the coupled parts.

Investigate the advantages of Gleason Curvic Couplings for your clutch and coupling applications. Write on your company letterhead for descriptive brochure.

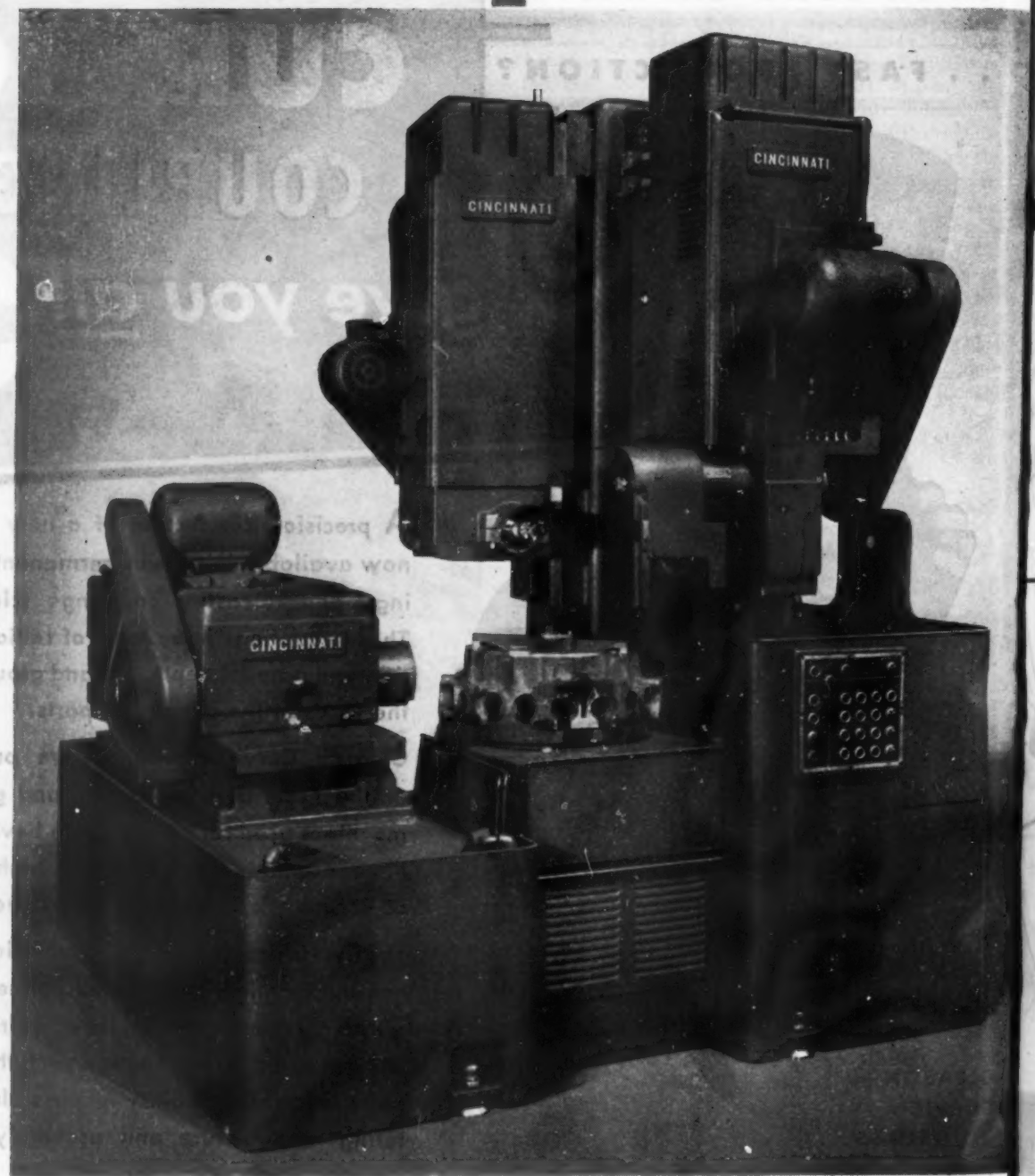
GLEASON Works
Builders of BEVEL GEAR MACHINERY FOR OVER EIGHTY YEARS

*TRADE MARK

1000 UNIVERSITY AVENUE
ROCHESTER 3, NEW YORK

CINCINNATI

COMPLETE



THE CINCINNATI M

MILLING MACHINES

TAILOR-MADE MACHINE *or a* SIMPLE FIXTURE

IT'S ALL A PART OF
CINCINNATI ENGINEERING SERVICE

Illustrations on these two pages show examples of Cincinnati Engineering Service. It encompasses complete equipment from a simple fixture and cutters on a standard machine to completely special machines and tooling tailored to your requirements. ¶ Cincinnati Application Engineers will be glad to discuss the adaptation of standard machines to meet your needs, or the building of special equipment from the ground up. Whatever your milling requirements, it will be to your advantage to talk it over with our engineers.

Name of part: Supercharger Front Housing
Material: Magnesium
Operation: Rough Mill 29 Pads
Speed: 1200 feet per minute
Feed: 40" per minute
Depth of Cut: 3/8" to 1/2"
Production: 7 parts per hour
Machine: CINCINNATI Special Ram Type Five Spindle Miller

Name of part: Frame
Material: Cast Iron
Operation: Mill Notches in Lugs
Speed: 103 feet per minute
Feed: 7" per minute
Depth of Cut: From Solid
Production: 36 parts per hour
Machine: CINCINNATI No. 1-18 Plain Automatic Miller

MILLING MACHINE CO. CINCINNATI 9, OHIO, U.S.A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U.S.A.

When the mad rush begins... competition will be terrific.

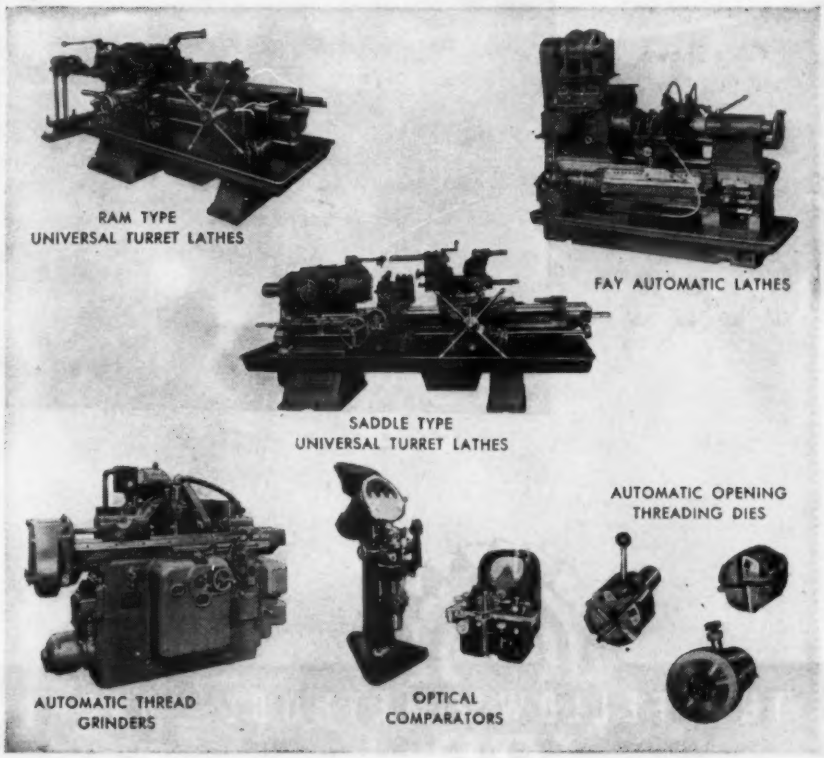
Wages will stay high — competition will be terrific. To remain in business and maintain full employment, manufacturers must use the most efficient machine tools obtainable. Scrap the old machines and cut production costs.

There's the case of a manufacturer whose purchase of a Jones & Lamson Turret Lathe nets him a saving of $700 to $1000 per month on a single part. This is but one of many similar cases.

Whether you buy War Surplus machines or new machines to replace your obsolete equipment, be sure that they can transmit *the horsepower and have the rigidity to use the carbide cutting tools which provide the fastest known method of metal turning today.*

Jones & Lamson machines *can* transmit the horsepower and *have* the rigidity to take full advantage of these tools. Send for our book, "Welcome to You and Your Problems." Or, better yet, ask for one of our engineers to assist you in making the most profitable investment.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.



Tough Problem GEARS

WITH THE F

ESSENTIAL DATA

★

WORK: 100 tooth Internal gear of 7.575 diametral pitch, 25° pressure angle, 13.200 inches pitch diameter.

CUTTING: On Fellows 6A-Type Gear Shaper—to 0.003 inch on tooth thickness.

SHAVING: *On Fellows No. II Internal Gear Shaving Machine* (illustrated) Time: 2 minutes, 20 seconds per gear.

INSPECTION: On Fellows "Red Liner" and Fellows Involute Measuring Instrument.

LAPPING: On Fellows LS-Type Gear Lapping Machine.

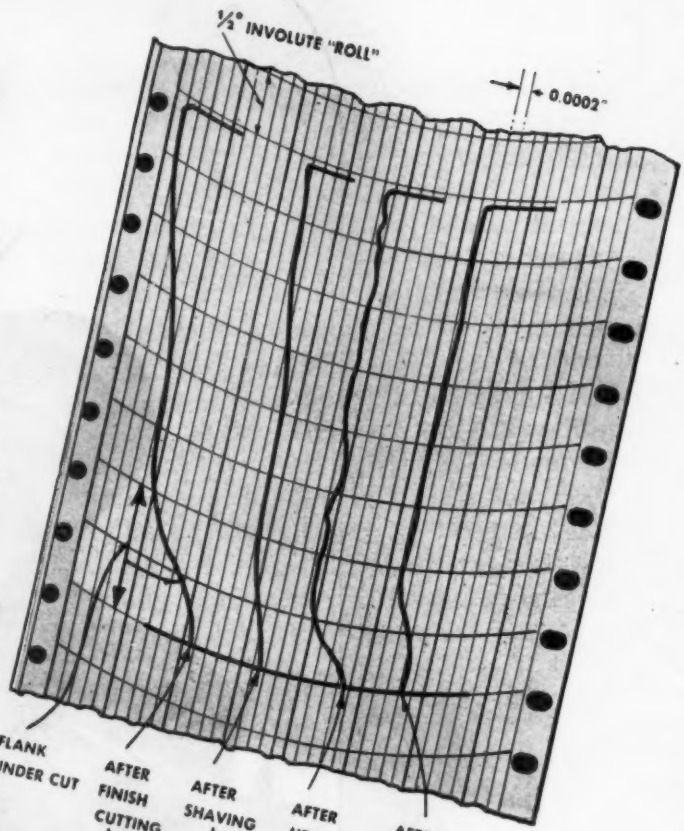
THE FELLOWS METHOD...MACHINES AND TOOLS FOR

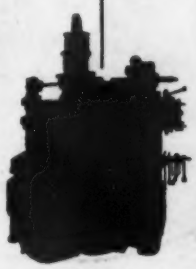
COME UNDER Control

FELLOWS METHOD

This Example from the Cincinnati, Ohio, Plant of *Wright Aeronautical Corporation* illustrates how the controlled precision of Fellows gear shaping, shaving, and lapping are coordinated to work with the known distortion which the teeth will undergo in the hardening fire . . . The teeth are purposely cut "off" pressure angle, to a tolerance which leaves for the Fellows No. II Internal Gear Shaving Machine (illustrated) the removal of only 0.0015 inch of stock from each side of the tooth—thus prolonging the effective life of the shaving tool . . . After hardening, a Fellows lapping operation most effectively restores the gear to its after-shaving perfection of tooth profile. The accompanying chart of this gear made on the Fellows Involute Measuring Instrument "tells the story".

"The Fellows Method" Catalog on request. The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit 2, Mich., or 640 West Town Office Bldg., Chicago 12, Illinois.




6A Fellows Gear Shaper

No. II Fellows Gear Shaver

Fellows "LS" Lapping Machine

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

THIS EQUIPMENT...

Here's how a CINCINNATI 6" x 30" Plain Hydraulic Grinder was tooled up to handle the grinding of diameters, profiles and shoulders on rod assembly.

CINCINNATI G

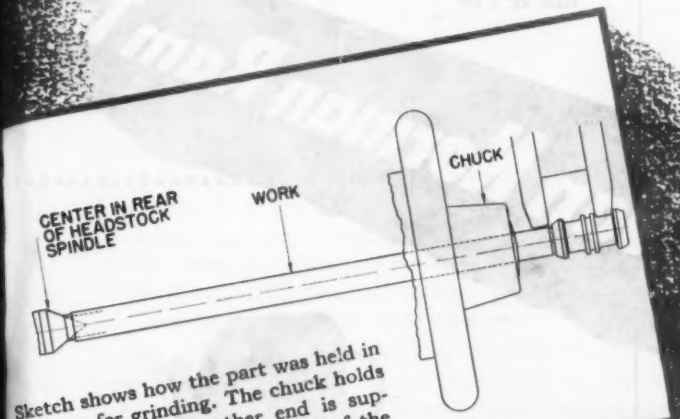
CIN

CENTER TYPE GRINDING MACHINES

CEN

FACILITATES PROFILE GRINDING OPERATION ON END OF LONG, SLENDER PART

Grinding the diameters, profiles and shoulders on the end of this long, slender rod assembly was a problem in itself, but still another consideration was the elimination of conventional faceplate drive to speed handling. Here's how Cincinnati Application Engineers worked it out. ¶ A CINCINNATI 6″ x 30″ Plain Hydraulic Grinder was equipped with a special live spindle headstock; pull-in chuck with adapter; hydraulic truing device with bar type cam (for an infinite number of bearing surfaces before the cam wears out), and a special gap table arranged to clear the handwheel on chuck. The work extends part way through the headstock, supported at the rear end by a center in the rear of the spindle, and at the front end by the chuck. The setup illustrated handled the job more economically than other methods, with loading and unloading quick and easy. ¶ Cincinnati Application Engineers will be glad to discuss your grinding problems with you, and endeavor to work out more profitable methods for handling your centertype and centerless operations. Write for more details.



Sketch shows how the part was held in position for grinding. The chuck holds one end while the other end is supported by a center in the rear of the headstock spindle.

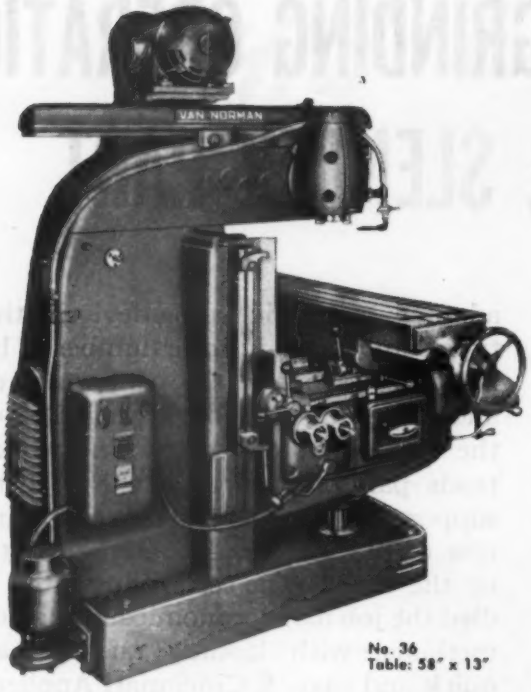
CINCINNATI

CINCINNATI *6″ Plain Hydraulic Grinding Machine. Catalog G-492-2 contains complete specifications. The Plain Hydraulics are available in 4″, 6″, 10″, 10″L, and 14″L sizes. Sweet's Catalog File gives a brief description.*

TI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

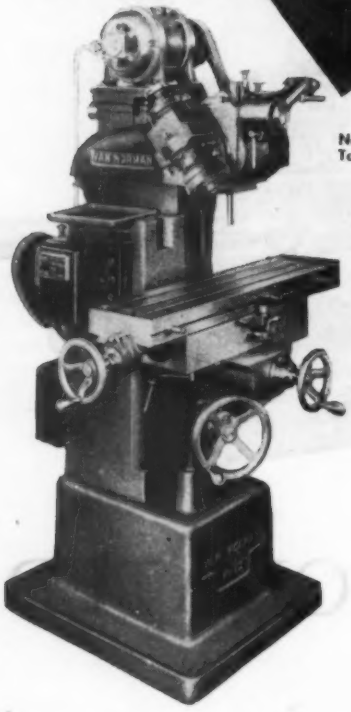
INES CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES



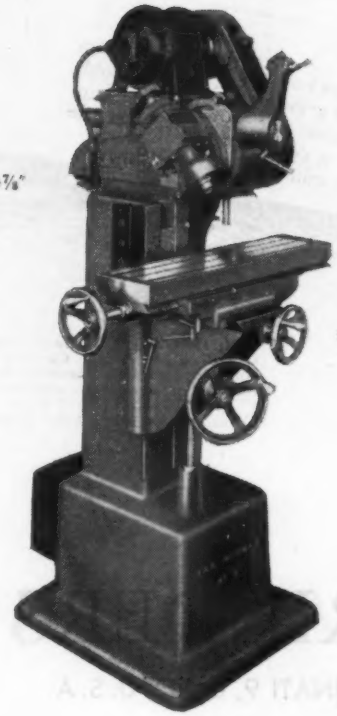
No. 36
Table: 58" x 13"

No. 22L
Table: 45" x 10"

Only Van Norman Ram Type



No. 12
Table: 37½" x 9³/₁₆"



No. 6
Table: 30" x 6⅞"

Ram-Type Milling Machines give you

★ HORIZONTAL

★ VERTICAL

★ AND ANGULAR

MILLING

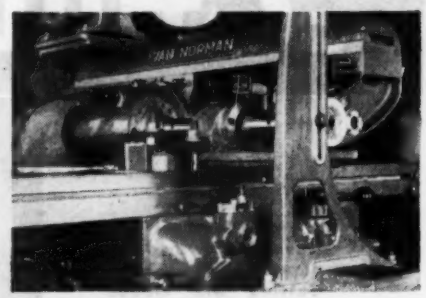
The big advantage of Van Norman Ram-Type Millers is their versatility. With these machines you can perform any kind of milling from horizontal to vertical simply by positioning the adjustable cutterhead. The result is increased machine production through elimination of idle operator and machine time. In addition, the adjustable cutterhead permits the operator to carry most jobs through to completion without changing the work setup . . . insuring accuracy and reducing rejects.

Here's a typical example of how Van Norman Ram-Type Millers fit into your general purpose and tool room picture. You have three ram-type millers. — Today the work schedule calls for two horizontal millers, one vertical. The operators simply position the cutterheads of two machines to horizontal and one to vertical and go ahead with the work. No waiting for specific machines . . . no loss in profits. Horizontal, vertical or angular, period to period, each Van Norman Ram-Type Miller can do the work.

Added to versatility, Van Norman gives you front and rear controls, exclusive single lever feed selector, movable ram, dovetail ram ways, plus other advantages which speed milling operations, save money and assure accurate work.

Investigate Van Norman Ram-Type Millers. They are available with plain or swiveling tables for every type of work. *Each machine will not only meet today's requirements but will be ready for tomorrow's jobs as well.*

The Ram-Type Miller used with the adjustable cutterhead in the vertical milling position and the operator using the front directional controls.



The Van Norman Ram-Type Miller with the head locked in the horizontal position for boring and facing.

With the cutterhead locked in an angular position, the operator is taking an angular cut on the workpiece, operating the Miller with the rear directional controls.

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"

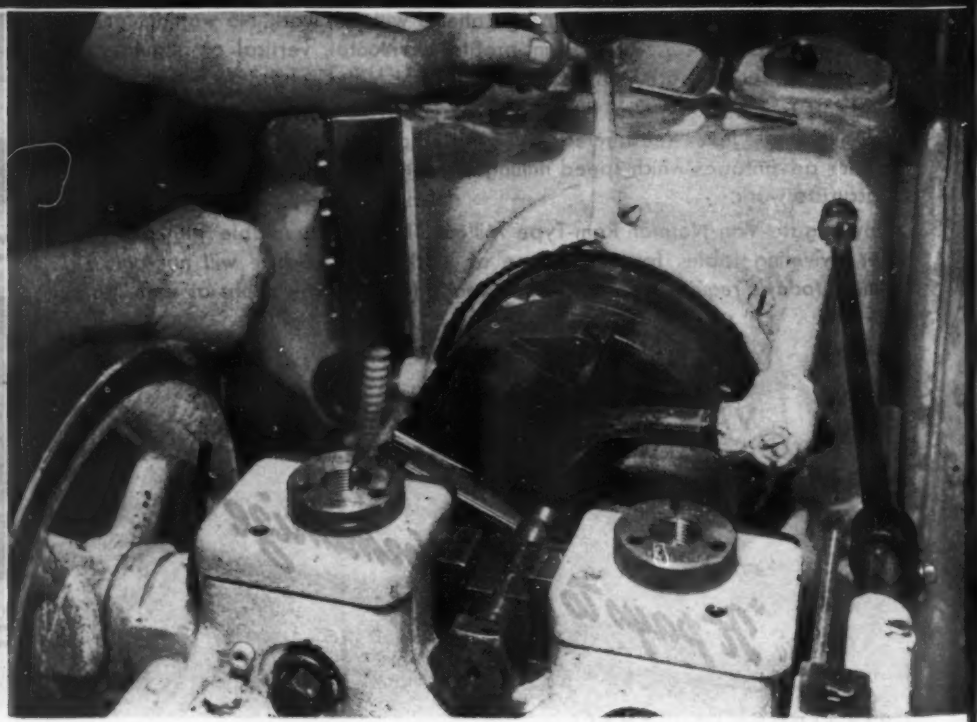
★ An Important Factor in Your Post-War Planning

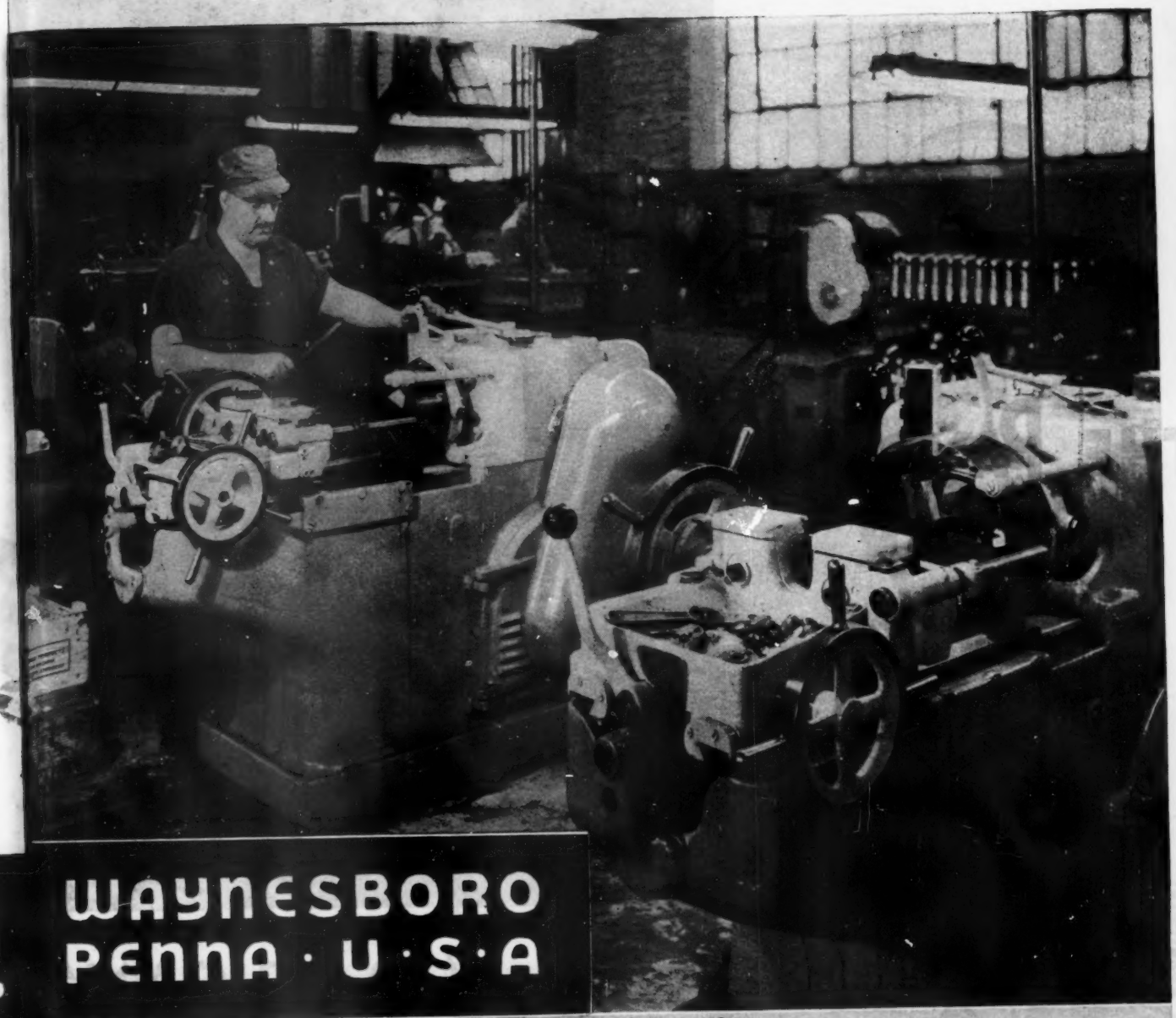
To meet post-war competition, plan to use Landis Threading machines and equipment exclusively for smooth operation and increased production at lower cost. Hundreds of America's foremost manufacturers have met seemingly impossible schedules with Landis during the war years and now are planning to meet post-war threading problems with Landis equipment.

Write for Bulletin H-75

LANDIS MACHINE CO.

A manufacturer of Naval Hardware employs Landis Thread Cutting Die Heads and Machines exclusively for threading countless thousands of threaded components used in the world's mightiest battle fleet.





WAYNESBORO
PENNA · U · S · A

The LANDIS LINE

THREAD CUTTING MACHINES
Landmaco Threading Machines
Bolt Factory Threaders
Automatic Forming and Threading Machines
4 Spindle Semi-Automatic Threading Machines
Pipe and Nipple Threading Machines

THREAD CUTTING DIE HEADS
Landmatic (for Turret Lathes and Screw Machines)
Landex (for Automatic Screw Machines)
Lanco (for Automatic, Semi-Automatic and Hand-Operated Threading Machines)
Lanco Pipe and Nipple Threading Heads
Stationary Pipe Die Heads
Reverse Taper Die Heads
Standard Rotary Die Heads

PRECISION THREAD GRINDERS
PIPE THREADING AND CUTTING MACHINES
ROLLER PIPE CUTTERS
CHASER GRINDERS
COLLAPSIBLE AND ADJUSTABLE TAPS

The Landmaco Threading Machine equipped with the Lanco Head producing Pivot Bolts to close tolerances with 100% inspection.

THE PAYROLL DOLLAR *buys more*

...WHEN "AMERICAN"

MULTI-PRODUCTION LATHES ARE USED

HERE, for example, is an "American" in one of our most prominent shops actually producing four (4) times more work than the fairly modern machine it replaced. In hundreds of plants "American" Multi-Production Lathes are lightening the burden of higher wages, shorter hours, increased taxes and inexperienced operators. That is why "Americans" are the choice of cost-minded production men. The many productive features responsible for such results are clearly illustrated and described by our new bulletin No. 445.

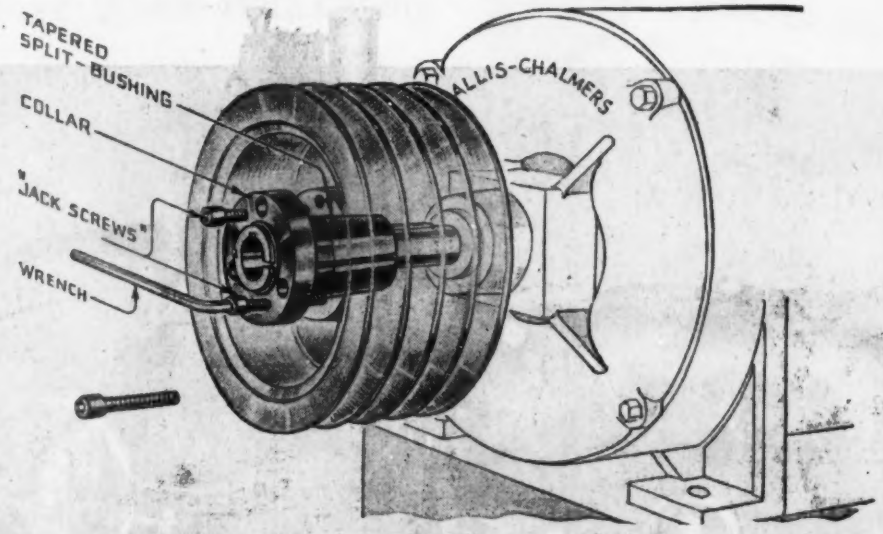
THE AMERICAN TOOL WORKS COMPANY

LATHES AND RADIAL DRILLS

CINCINNATI, OHIO, U. S. A.

X-Ray View

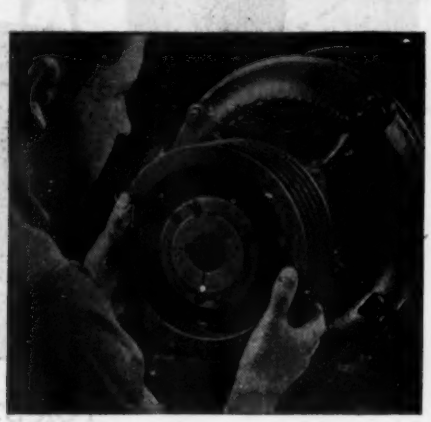
OF ALLIS-CHALMERS' NEW "MAGIC-GRIP" SHEAVE



Fastest mounting and demounting sheave on the market, the new "Magic-Grip" costs you nothing extra.

1 **Remove three capscrews** from bushing collar. A handy wrench — supplied with each sheave — is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.

2 **Insert two capscrews** in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.



3 **Remove sheave from shaft.** Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1770

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES

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How To Grind A Taper

FOR STRAIGHT GRINDING

Turn regulating wheel base swivel screw back to zero where base will be parallel to work axis and ready to grind. Hydraulic traverse of regulating wheel base speeds alignment of work rest blades. Manual plus hydraulic traverse permit quick alignment of regulating and grinding wheel for unmarred finishes.

LANDIS TOOL

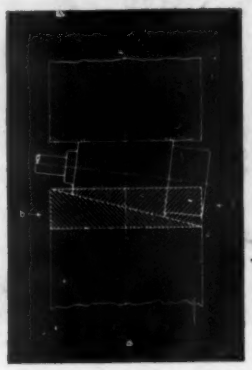
Precision Grinders

LANDIS TOOL COMPANY

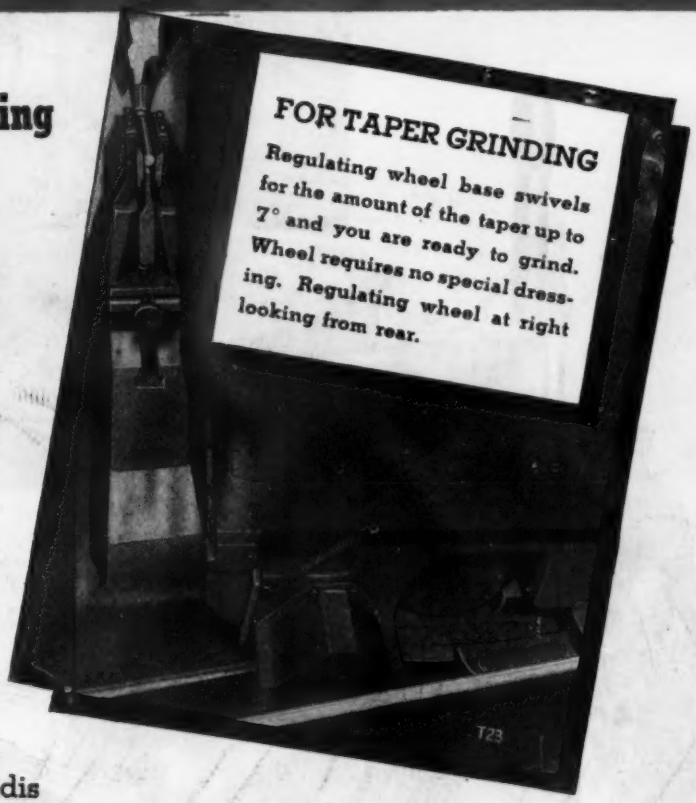
Without Diamonding The Wheel On LANDIS TOOL CENTERLESS

Why You Save Wheel Diamonding

Regulating wheel after swiveling showing position for grinding taper on Landis Tool Centerless.



Regulating wheel position for grinding taper if it could not swivel. Sectioned areas show amount of wheel to be diamonded off for taper grinding (a) and additional amount to return to straight grinding (b). (Exaggerated slightly to bring out detail.)


FOR TAPER GRINDING
Regulating wheel base swivels for the amount of the taper up to 7° and you are ready to grind. Wheel requires no special dressing. Regulating wheel at right looking from rear.
T23

• Tapers can be ground on the Landis Tool Centerless Grinder with big savings in time and money. The swiveling feature of the regulating wheel base makes it possible to grind tapers up to 7° merely by changing the setting of the wheel base by means of the calibrated regulating wheel base swivel screw.

You save the time of diamonding the regulating wheel. Not only the time required to put on the original taper but also the time of removing it so that straight work can be done plus the longer diamond life which results. You also save on the Landis Tool Centerless because of longer regulating wheel life, since none of the wheel must be removed to grind the taper.

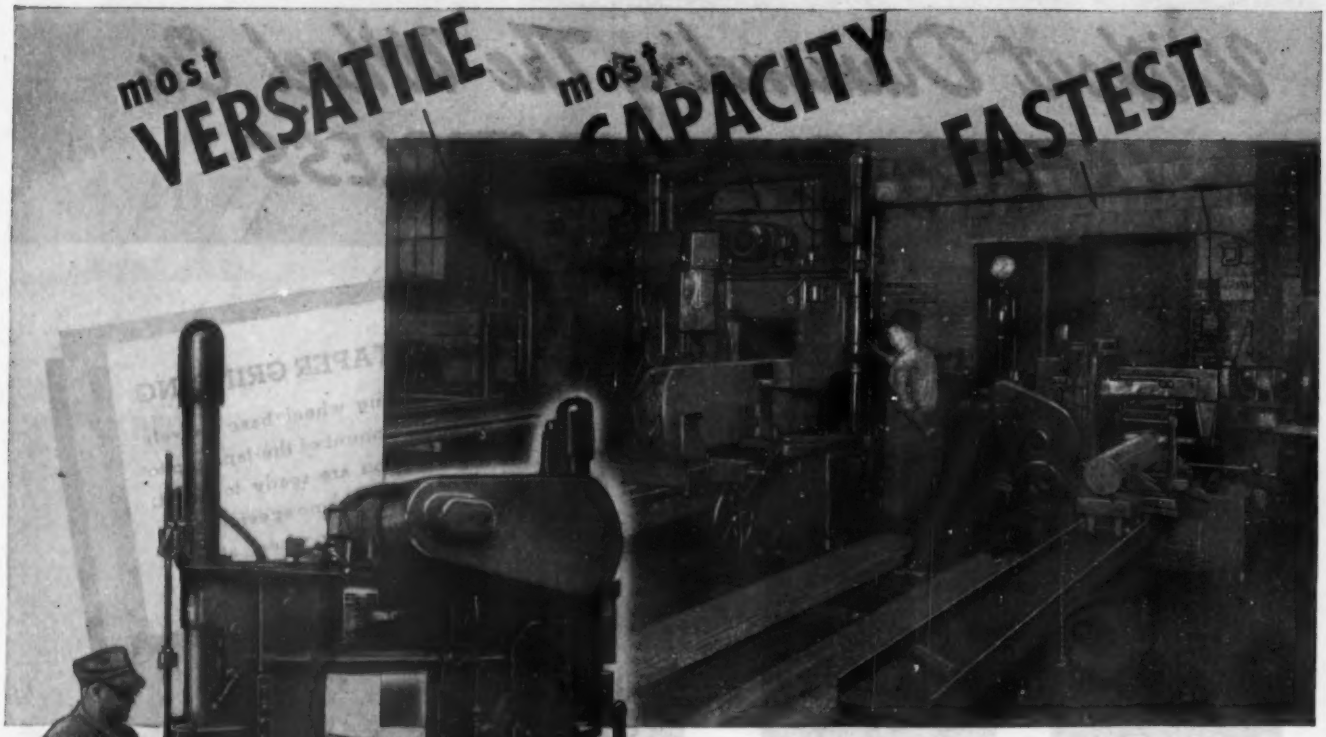
Finishes will be better, too, when tapers are ground the Landis Tool way by swiveling the regulating wheel base. The peripheral speed is constant, force exerted on the work is equal and there is no slippage.

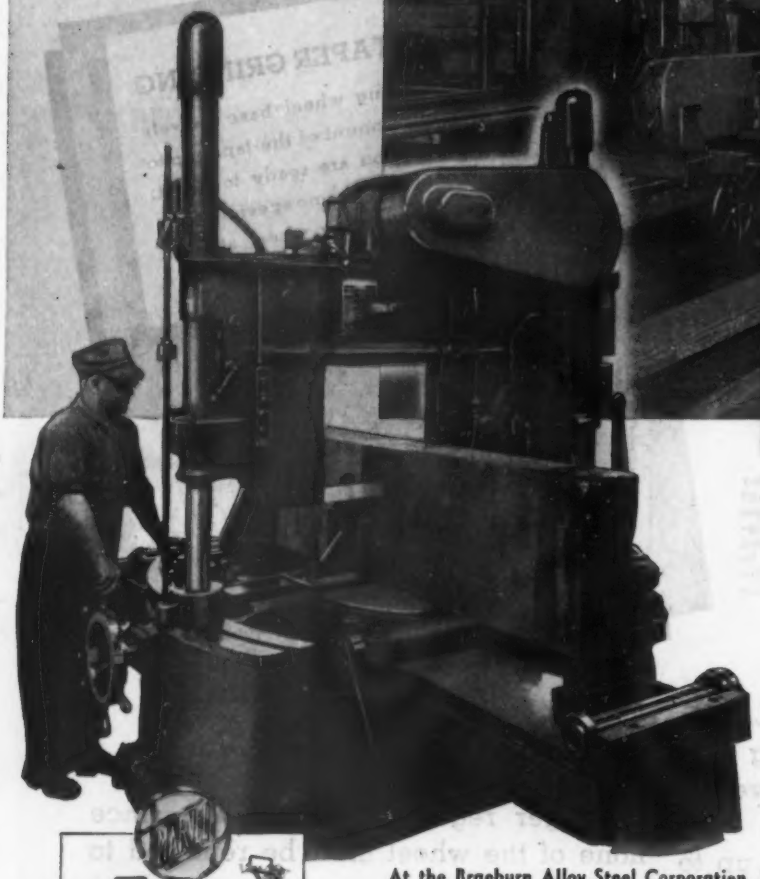
For full information on the Landis Tool Centerless Grinder either for taper or straight grinding, write for Catalog T44.

LANDIS TOOL Company

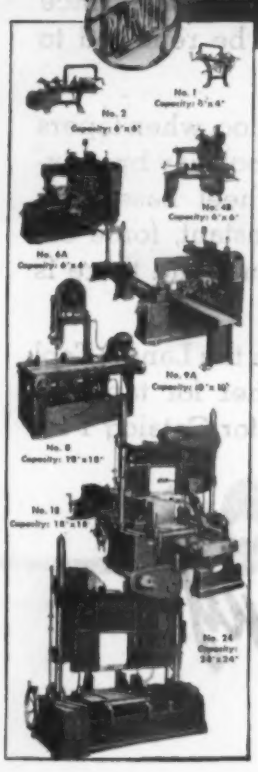
WAYNESBORO, PA.

most VERSATILE — most CAPACITY — FASTEST





EACH *first* IN ITS CLASS



At the Braeburn Alloy Steel Corporation, Braeburn, Pennsylvania, there is a lot of steel to be cut—not only in tonnage but in types of steels, variety of cuts and range of sizes. Still the Braeburn Corporation can give prompt cutting-off service on any order, whether it be for a single tool steel flat, a thousand gear blanks or a giant die block (up to 18" x 18" cross section). They have equipped their cutting-off department to handle every type cutting-off job with a MARVEL No. 8 Metal-cutting Band Saw, by far the most versatile saw built; a MARVEL No. 9A Automatic Production Saw, by far the fastest saw; and a MARVEL No. 18 Giant "sister" the MARVEL No. 24 (capacity 24" x 24"), is the largest capacity hack saw built. With this battery of modern sawing equipment this firm gets the utmost in Speed, Accuracy and Economy, no matter what the job calls for. Furthermore, because of the automatic features of these saws, one operator takes care of all 3 of them.

No matter what your sawing needs, from the most inexpensive dry cutting shop saw to the largest capacity giant, there is a MARVEL Saw exactly suited to your needs and it's the best saw of its type.

For quick reference see our section in Sweet's File—Mechanical Industries or write for catalog

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 W. Bloomingdale Ave. **Chicago 39, U. S. A.**

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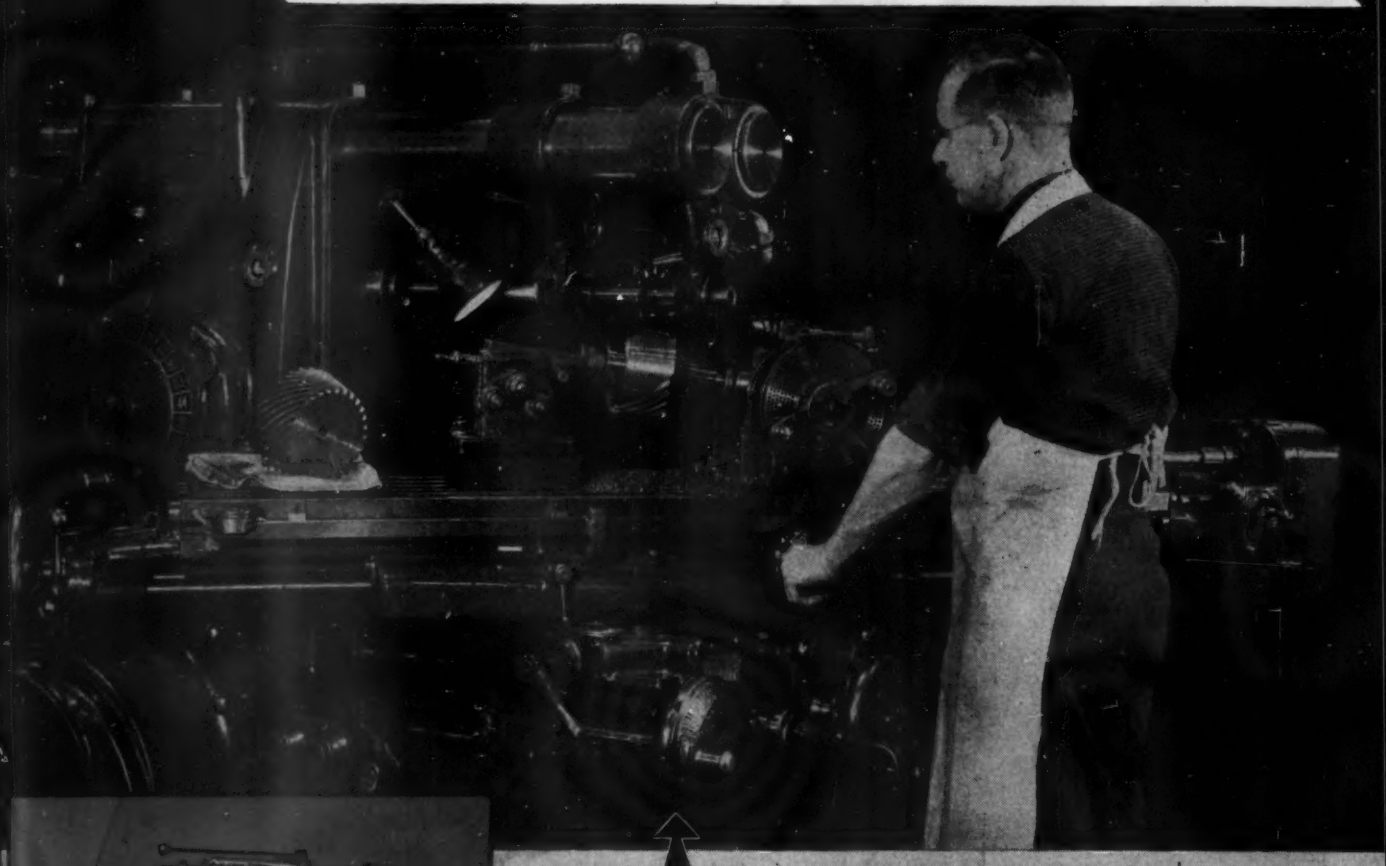
MARVEL SAWS

PUT IT ON A *Milwaukee*

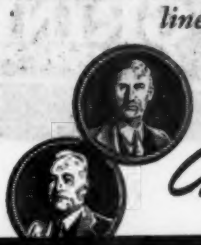
TO MILL IT · · WITH SPEED · · PRECISION · · PROFIT



Milling Taper Reamer: in this operation a Milwaukee 3K Universal is milling the flutes in a 20° included angle taper reamer. A low lead attachment is used with a Milwaukee Model K Dividing Head and tailstock for driving, holding, and indexing the workpiece. The space between each flute is measured by less than one turn of the 5 to 1 ratio Milwaukee Dividing Head. A Milwaukee Style B Arbor employing both intermediate and outer arbor supports is used to hold the form cutter.

"When the job is a bit tricky — play it safe — put it on a Milwaukee" — that's what experienced machine-shop men say. The range — power — precision of Milwaukee Milling Machines — their versatility in handling a wide variety of intricate "precision" milling operations with the least time and trouble —has made them the preferred machines wherever metal is milled.

Write for complete information on the Milwaukee line of more than 70 models of milling machines.



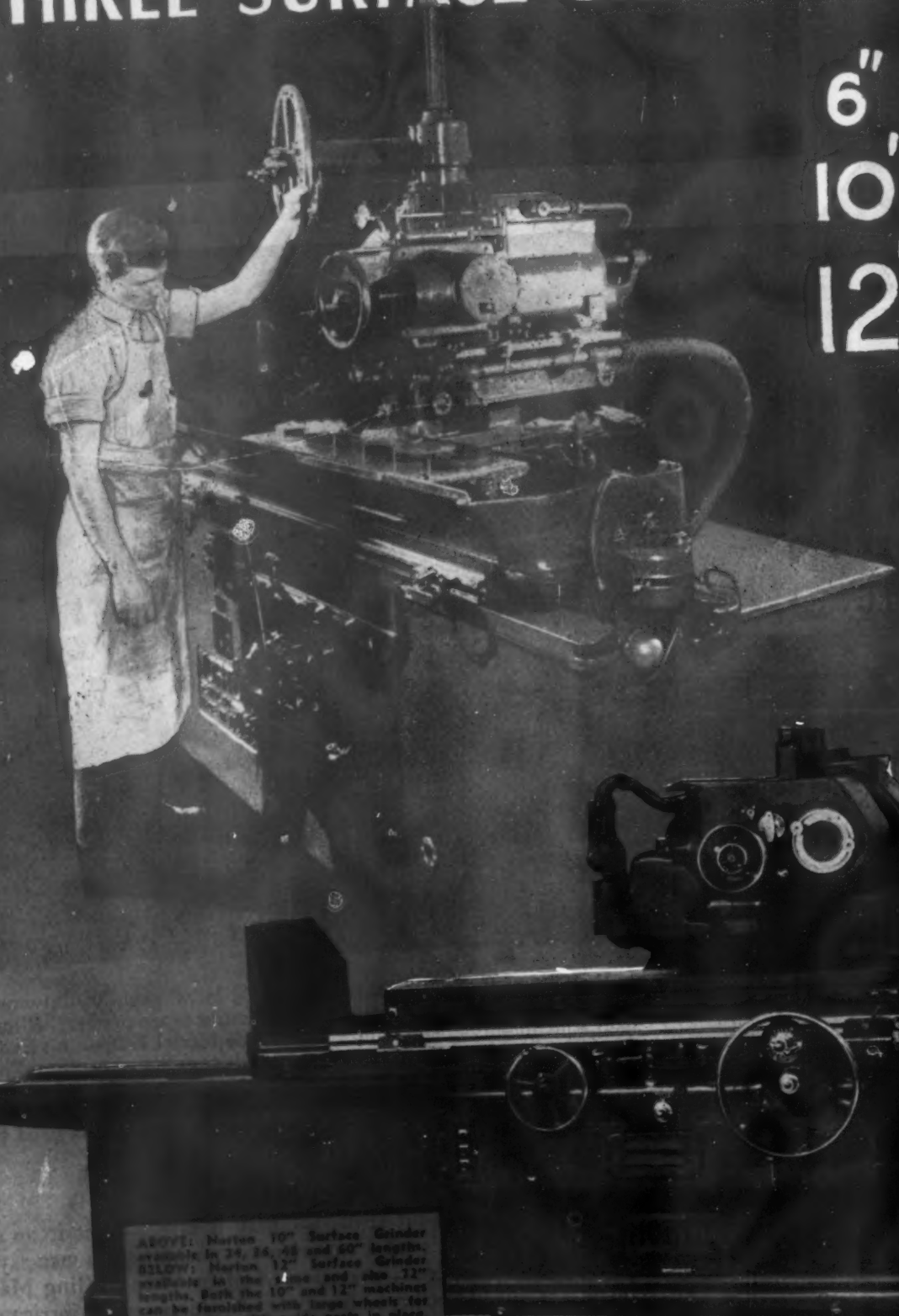
KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

Milwaukee Machine Tools

THREE SURFACE GRINDERS

6"
10"
12"



ABOVE: Norton 10" Surface Grinder available in 24, 36, 48 and 60" lengths. BELOW: Norton 12" Surface Grinder available in the 36" size and also 72" lengths. Both the 10" and 12" machines can be furnished with large wheels for grinding dies with guide posts in place.

NORTON GRINDERS
and Lappers

. . . Designed for Service with Low Maintenance

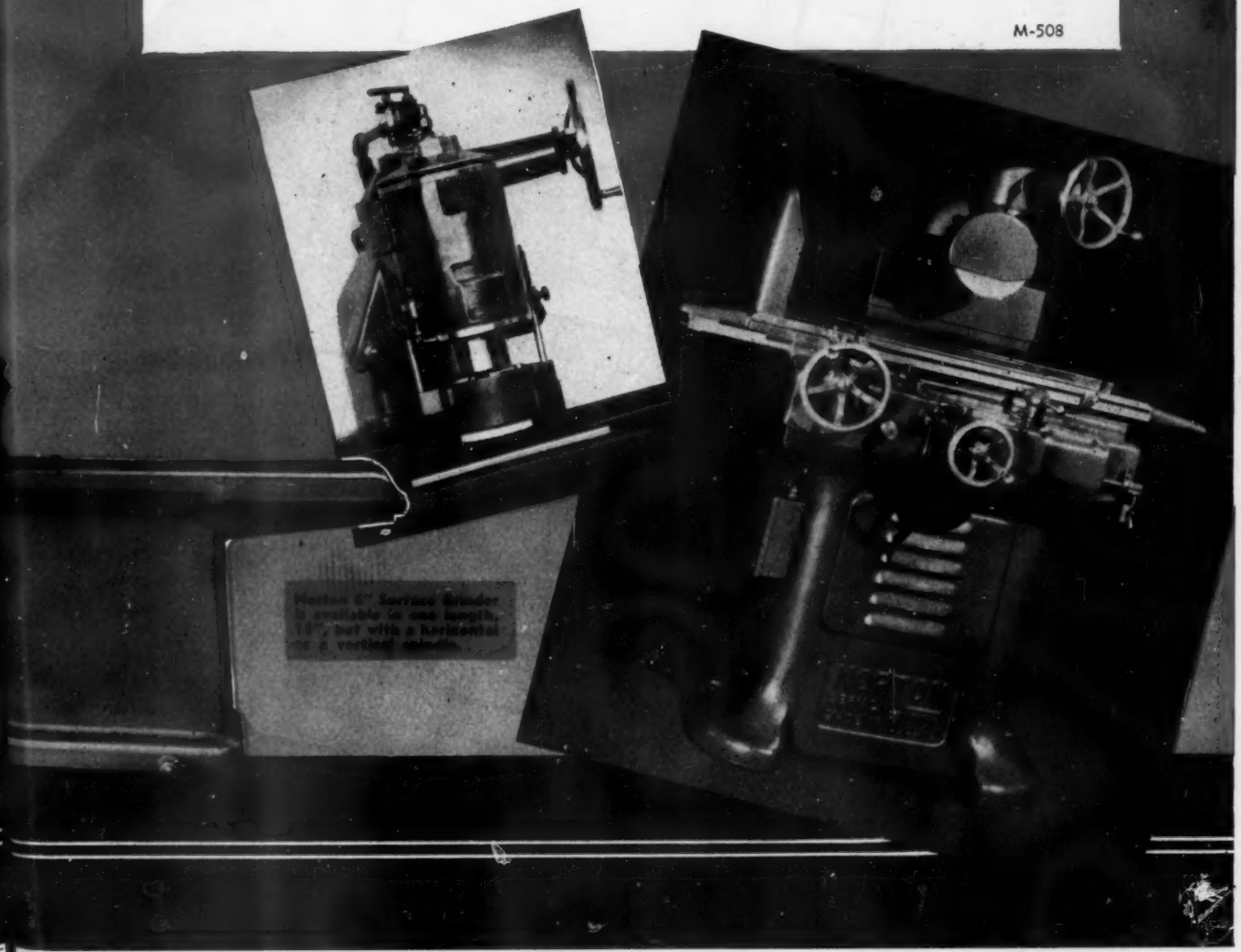
THESE sturdy compact Norton Surface Grinders are designed to meet the requirements of tool and die shops as well as economical manufacturing production. They are available in various arrangements, including hydraulic table traverse in a wide range of speeds. Fast and slow hand cross feeds or hand and hydraulically operated automatic power cross feed can be had in the same machine.

The Norton 6" surface grinder can be furnished equipped for wet grinding or with a dust collecting unit for dry grinding. The 10 and 12" machines are arranged for wet grinding.

Individual catalogs describing each of the three surface grinders are available upon request — no obligation.

NORTON COMPANY • WORCESTER 6, MASS.

M-508



10-year

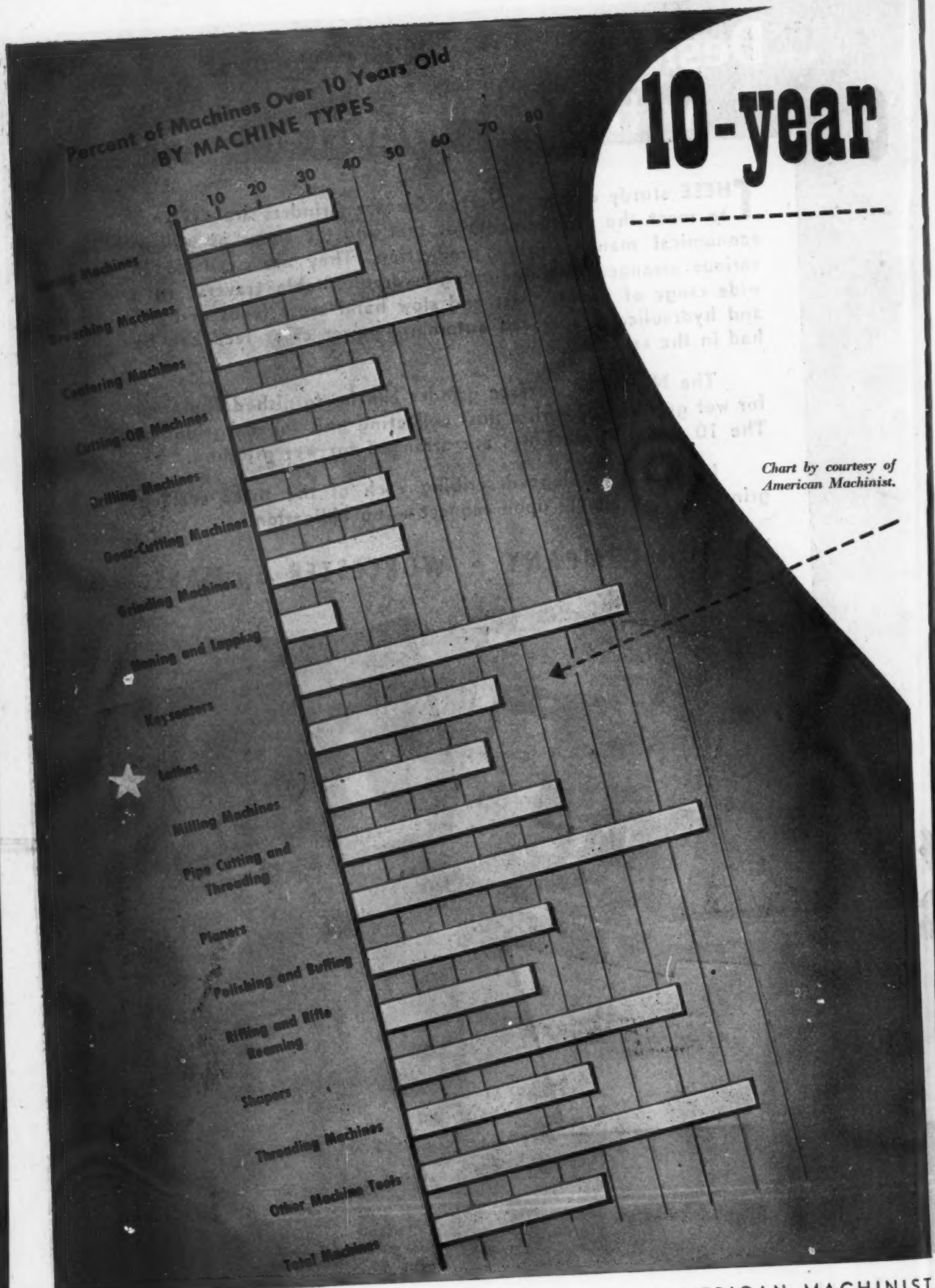


Chart by courtesy of American Machinist.

old lathes are ~~out of date~~ no economy

Plants with engine lathes that are 10 years old, or more, cannot expect to match the production quality or economies of those which take advantage of modern equipment.

They cannot hope to compete, now or in the future, with the high accuracy and low-cost machining made possible by such Monarch developments as:

Standard turning machines

Precision toolroom lathes

Automatic sizing machines

Form turning and boring machines

Shapemaster machines for turning odd-shaped work

10″ Precision Manufacturing Machines

Magna-Matic all-electric turning machines

Ball bearing taper attachments and taper attachment variators

10″ Sensitive Precision Toolmaker's Lathes

The ability of these Monarch machines to cut costs, increase and improve production has long been proved. If you are not fully informed of their advantages, ask any Monarch office for details. Our engineers will show you proof and furnish job analyses for your own work, to help you produce more goods for more people at lower cost. If your reconversion needs cannot be met by our present deliveries, we'll gladly try to assist you in the selection of Monarchs from government surplus stocks.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

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The Monarch fully automatic, all-electric Magna-Matic is the most universal turning machine in American industry.

YOUR PLANT NEEDS THIS POST WAR MACHINE

QUAD-ACTION

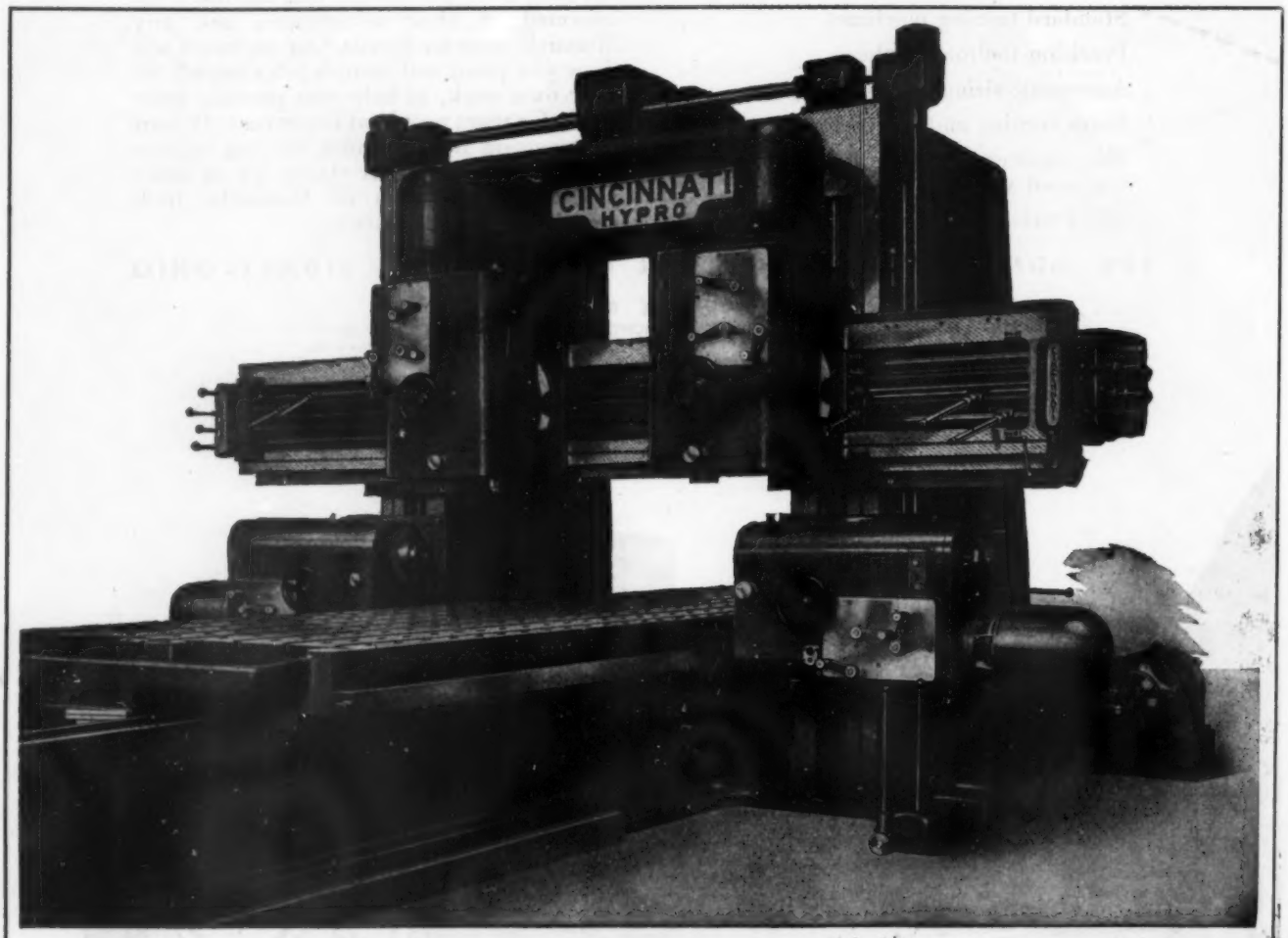
HYPRO

PLANER TYPE MILLING MACHINE

In the highly competitive post war period, the Hypro Planer Type Miller offers exceptional advantages.

Its four heads work simultaneously and perform several operations at once—using only one set-up—saving time and manpower. Each head is individually powered with a 10 H. P. motor. Its massive, compact construction, scientifically reinforced, adds to its rigidity. Combination herringbone gear drive to table assures smooth transmission of power, free from all side thrusts and guaranteeing extreme accuracy.

For more information regarding this versatile machine and its application, write today for Catalog AM-105.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

CONTINENTAL TOOL WORKS
CTW
EX-CELL-O CORPORATION

Continental
CUTTING TOOLS

- Boring Bars and Tools
- Broaches
- Broach Pullers
- Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

. . . is the Word for *Continental* Inserted Blade Face Milling Cutters

● Continental Type "R" Inserted Blade Face Milling Cutters and Shell End Mills have hardened cutter bodies and are practically indestructible. This prevents mutilation of blade slots and permits accurately ground and hardened surfaces for contact with machine arbors. Continental Cutter bodies have no screw threads or serrations to wear out, strip or become plugged. Wedge shaped blades are securely held in place by positive clamp lock . . . are easily removed without injury to blade or carbide tip. Continental Type "R" blades are longer, giving more grinds per blade. Blades can be quickly and individually adjusted. This reduces waste when carbide tipped blades are used. Continental Type "R" cutters are available in a wide range of sizes. Can be furnished with carbide tipped or high speed steel blades—in positive or negative rake. Continental Type "R" cutters "can take it." For lower tool cost on "tough" jobs specify Continental Type "R" Cutters.

CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation

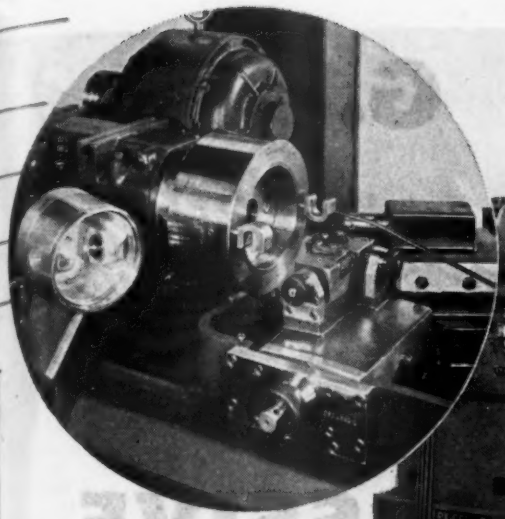
DETROIT 6, MICHIGAN

For quick future Action:
1. Lower Unit Cost (Multi-Operation Machines)*
2. Rebuilding Active Sales Force
(a) District reorganization
(b) Sales Training?
3. New Advertising and Sales Promotion
4. Distribution and N

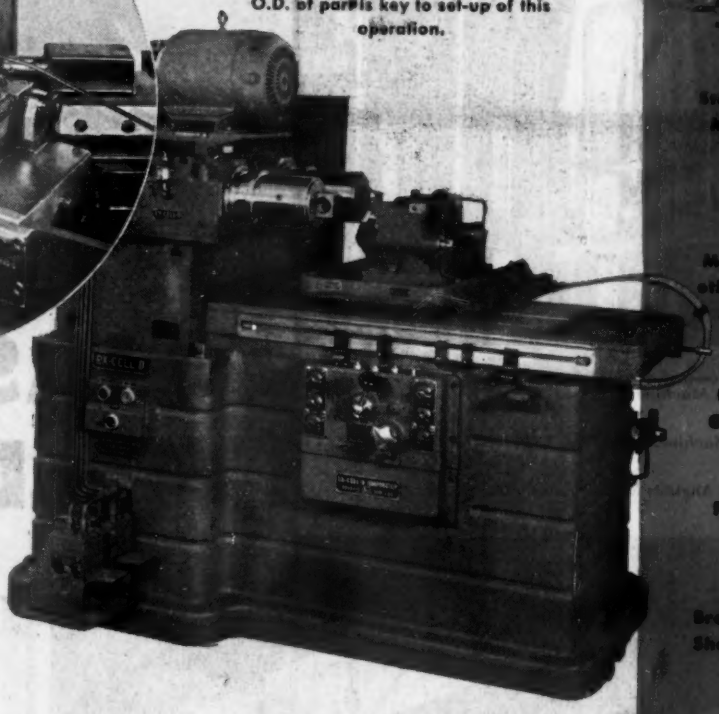
HIGH on your

*with machines
designed for the job
by EX-CELL-O

EX-CELL-O CORPORATION



Below: Form turning O.D. of piston is operation here on an Ex-Cell-O Precision Boring Machine (Style 112-C). Master cam conforming to O.D. of parts key to set-up of this operation.



Above: Finish bore, facing, and chamfer operations are performed on piston by locating part on O.D. of dome; loading bar is inserted through wrist pin holes long enough to enable hydraulic clamps to take hold and pull piston against dome face. Fixture moves in, bores two diameters, and faces, in open end of skirt; angular slide then moves back and generates chamfer. Machine is Ex-Cell-O Style 2112-A Precision Boring.

XLO

EX-CELL-O for PRECISION

Standard and Special Multiple Way-Type Precision Boring Machines

•

Multiple Drilling and other Special Purpose Machines

•

Precision Thread Grinding Machines

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Precision Lapping Machines

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Broaches and Broach Sharpening Machines

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Continental Cutting Tools

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Tool Grinders

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Hydraulic Power Units

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Fuel Injection Equipment

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R. R. Pins and Bushings

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Pure-Pak Paper Milk Bottle Machines

•

Aircraft and Miscellaneous Production Parts

reconversion list

Already is indicated the nature of things to come, as far as tomorrow's production costs are concerned. One main source for lower costs will be machine tools that offer more efficient methods for production, through progressive stations and multiple operations. In developing standard and special machine tools that perform a variety of close-limit operations, Ex-Cell-O has had unique experience that eminently qualifies it to meet the production problems facing the major industries of this country. Write to Ex-Cell-O Corporation, Detroit 6, Michigan, today.

Where increased production, high accuracy, and greater economy through multiple operations are required . . . See Ex-Cell-O First!

Right: If you do not now receive Ex-Cell-O TOOL TIPS, devoted to precision and speed in production, send your name, company, address and position to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.

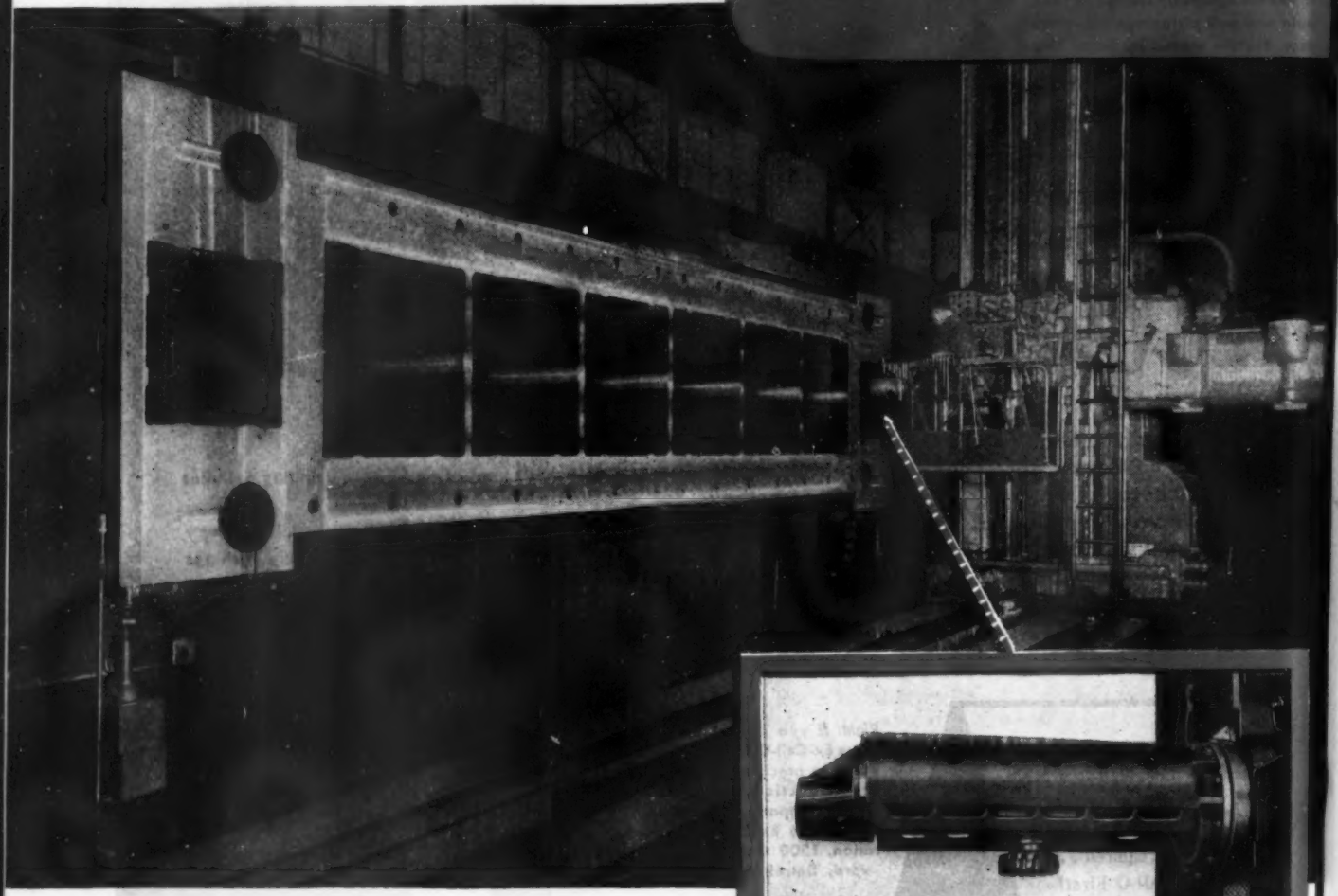
N DETROIT 6, MICH.

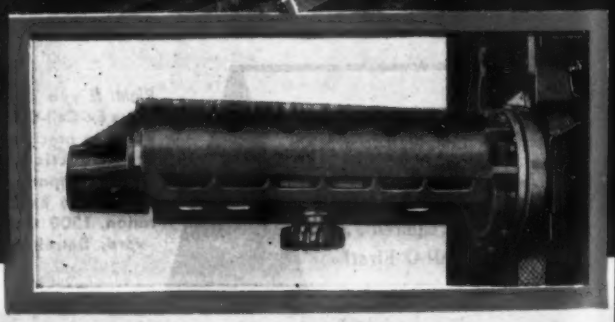
(Above) *Small Press Bed Mounted on a Power Rotary Table. Only One Work Setting is Required to Machine This Bed.*

(Below) *Large Press Bed Machined on a G. & L. Floor-Type Machine.*

(Inset) *Spindle Support and Angular Milling Attachment for Machining Guides.*

G. & L. cuts machining time 50% on MASSIVE WELDMENT

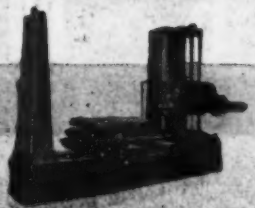




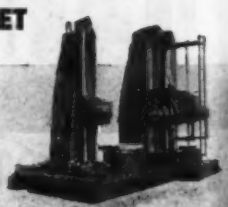
G&L

GIDDINGS & LEWIS

138 DOTY STREET



Right: G. & L. Table Type Machine.



Right: G. & L. Floor Type Machine.

OPEN CONSTRUCTION SIMPLIFIES VARIOUS OPERATIONS...EXTRA SETUP AND WORK HANDLING ELIMINATED...ACCURACY OF FINISHED PRODUCT IMPROVED

Massive weldments of all kinds are machined *better* and *faster* on G. & L. Horizontal Boring, Drilling and Milling Machines. Open floor-type construction plus timesaving attachments eliminates excessive work settings and simplifies machining operations.

Two typical press bed weldments are shown in the process of being machined. Size of the beds merely indicates the wide working range of G. & L. Floor-Type Machines. The larger press bed is 30 ft. long by 11 ft. wide and the upper surface is shown completely milled, drilled and bored. Through the use of a spindle support arm and angular milling attachment, the guides of the press bed are being machined without changing the work from the original setup.

Overall Machining Time Reduced from 90 to 45 Hours on Small Press Bed

Floor-to-floor time was cut in half by using a G. & L. Floor-Type Machine equipped with a rotary table. The sequence of operations on the 140" x 112" bed weldment includes (1) Surface milling cut; (2) Keyseating cut; (3) Milling bottom of bed after table is indexed 180°; (4) Milling guides by using a standard angular milling attachment. Only one setup was required to complete all operations accounting for the saving in overall time.

Increase Production...Reduce Costs

If you are confronted with the difficult task of machining large, bulky, hard-to-handle weldments or machinery components, G. & L. Horizontal Boring Machines will solve your production and machining problems. Consult Giddings & Lewis engineers now regarding the use of these versatile machines. They can help you convert expensive machining operations into profitable production.

Our engineers are ready to assist you in adapting war surplus Giddings & Lewis equipment to your needs.

MACHINE TOOL CO.

FOND DU LAC, WIS.

G. & L. Direct Sales and Service Representatives

We have established four regional offices for G. & L. sa and service engineers to supplement our dealers' effo Do not hesitate to call them direct in an emergency.

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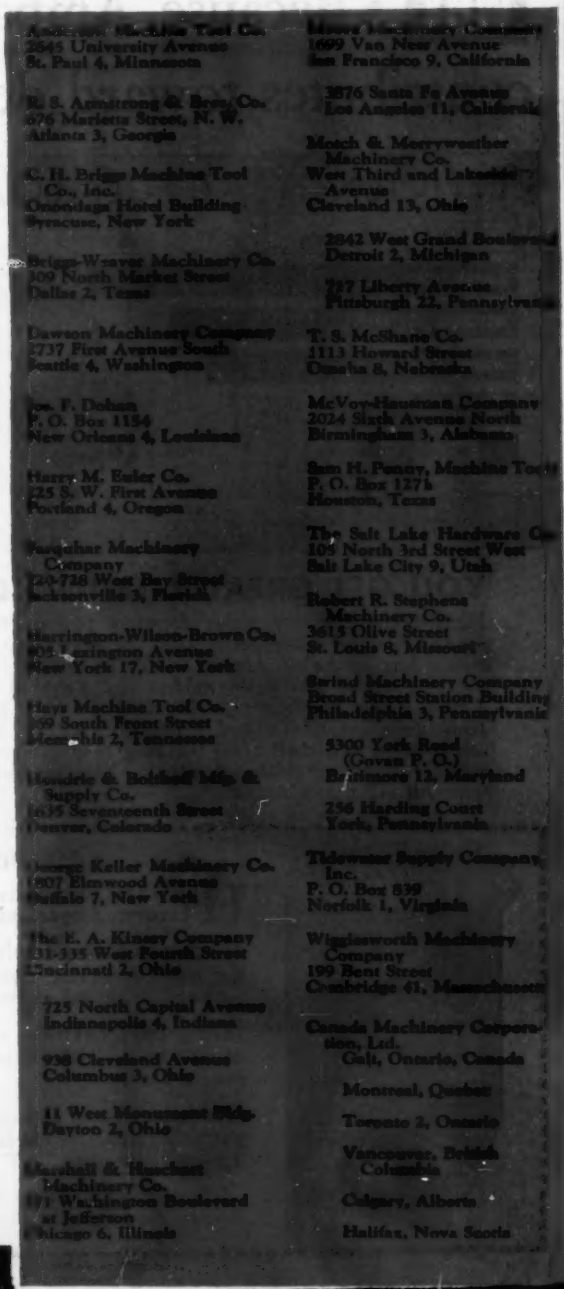


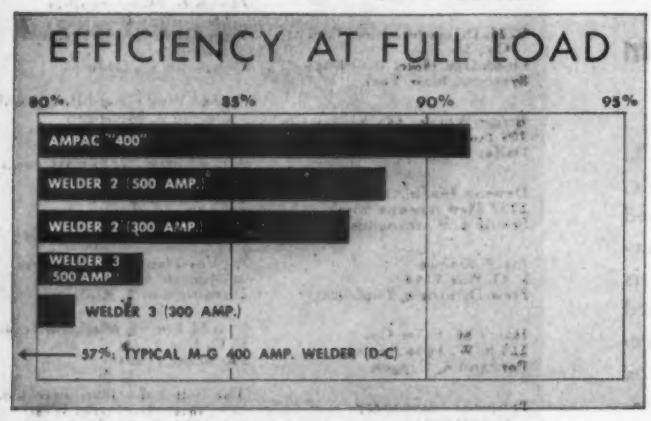
HERE'S THE WAY TO

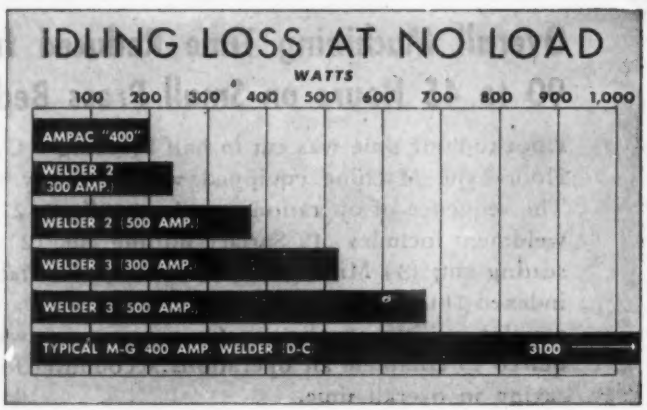
Cut Welding Cost

FOR POSTWAR WELD PRODUCTION

HOW • By replacing your present rotating type d-c machines with economical Ampac a-c welders.

WHY • Because Ampac's lower power consumption contributes toward decreased cost of operation.





YOU GET GREATER EFFICIENCY...

High welder efficiency means *decreased* power consumption — and therefore *lower power bills*. Note in above chart the outstanding rating of Ampac "400" in comparison with the two largest selling a-c welders and a typical d-c unit. Ampac is *tops* in efficiency at full load... and at lower currents maintains this efficiency rating. *That's* a record no other welder can challenge! It's long been proven that a-c welding gives you high efficiencies. You get the *highest* with Allis-Chalmers Ampac!

AND LOWER IDLING LOSS...

Idling loss during welding production is unavoidable since the arc is struck periodically. That means current consumed during this idling time is sheer waste. Thus if you *reduce* idling loss you automatically get *greater* welding economy. Note Ampac's low-idling loss as illustrated in the above comparison chart. At 2¢ per kw/hr in a full day the d-c unit wastes $1.49. But Ampac's loss is *less than 10¢!* Greater operating efficiency—lower idling loss . . . that's Ampac's *cost-cutting* offer for postwar weld production.

CASE HISTORY PROVES AMPAC'S GREATER ECONOMY

HERE ARE the results of an actual test made between Ampac and a comparable d-c unit.

Machines Compared: a leading 200 ampere d-c motor-generator type welder . . . and an Ampac 200 ampere a-c welder.

Idling Loss Test: d-c unit showed idling rate of 1.63 kw... Allis-Chalmers Ampac had idling rate of .09 kw.

KW Input Test: (providing same current output, using same type electrode): d-c unit averaged 9.3 kw . . . Ampac "200" averaged 5.2 kw.

Thus while furnishing the *same* welding power output, Ampac "200" used only 56% as much current . . . and had but 6% of the d-c unit's idling loss. Think what *that* means in terms of welding economy!

Large-scale welding will play a major part in postwar production. And *cost* will be all-important! For postwar markets will bring *stiff competition.*

Prepare *now* for greater postwar weld economy. Switch to Ampac a-c welders. Get full details from our nearby welder dealer or district office. Or write direct to ALLIS-CHALMERS, MILWAUKEE 1, WIS.

ALLIS-CHALMERS

A 1820

It is reported that . . . . . .

One of the obstacles in the way of large-size home television is the cost of the necessary aspherical lenses. A new material and method makes it now possible to mold these accurately of plastic at much lower cost. *Polaroid Corp.*

get ready with **CONE** for tomorrow

A "plastic foam" has been developed that is semi-rigid and weighs only about one-seventh as much as cork.—*U. S. Rubber Co.*

get ready with **CONE** for tomorrow

A western college is preparing courses in the management of small business, particularly for returned veterans. *Western Reserve University.*

get ready with **CONE** for tomorrow

Before the war we imported about one million glass eyes from Germany. Now an American manufacturer is reported to be filling a Russian order for 50,000 plastic eyes and to promise them for the use of our civilians later in the year. *American Optical Co.*

get ready with **CONE** for tomorrow

Three coal companies and six railroads are to collaborate in a million dollar research program to improve the coal burning locomotive. *Bituminous Coal Research, Inc.*

get ready with **CONE** for tomorrow

An automobile manufacturer is expected to enter the farm market with a number of new tools including a modified flame thrower for killing weeds. *Graham-Paige Corp.*

get ready with **CONE** for tomorrow

A new electronic piston ring inspection instrument uses beams of light to check accuracy within 0.001 inches in less than five seconds. *Sheffield Corp., Dayton.*

get ready with **CONE** for tomorrow

A new process claims to be able to electroplate aluminum with any of the conventional plating metals. *Alumon Euthone Co., New Haven.*

A new glass resists heat up to 1650 degrees Fahrenheit. *Vycor—Corning Glass Works.*

get ready with **CONE** for tomorrow

A new Diesel engine burns natural gas, coke-oven gas or sewage gas, as well as oil, without shutting down to exchange parts. *Cooper-Bessemer Corp.*

get ready with **CONE** for tomorrow

A new anodizing process makes magnesium resistant to corrosion. *Consolidated Vultee.*

get ready with **CONE** for tomorrow

The craft of gem cutting is being taught in this country to returned veterans in an effort to hold the advantage in this field that the war has given us. *Gabriel Williams, N. Y.*

A 96-pound bearing produced by powder metallurgy is claimed to be the largest of its type yet made. *Chrysler Corp., Amplex Div.*

get ready with **CONE** for tomorrow

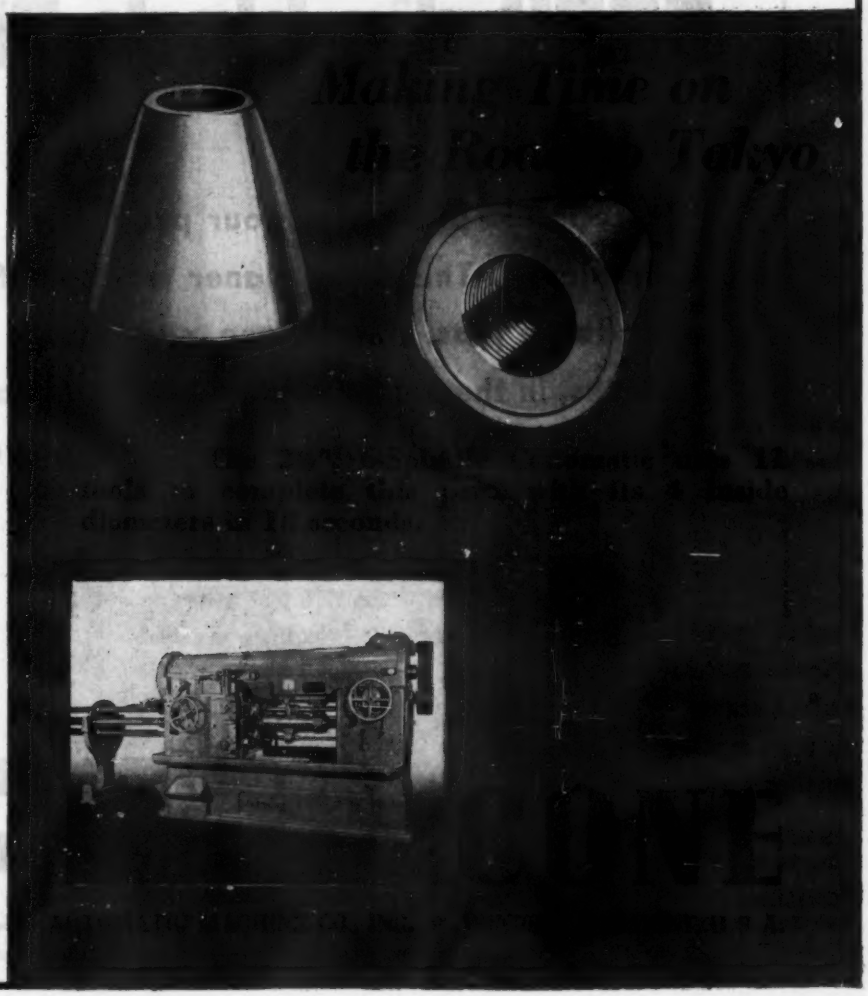
The first direct drive steam turbine locomotive to be built in the United States is undergoing tests to determine its adaptability to long-distance high-speed freight and passenger service. It is said to be capable of pulling a passenger train at 100 miles per hour. *Penn. RR Baldwin Locomotive Works—Westinghouse.*

get ready with **CONE** for tomorrow

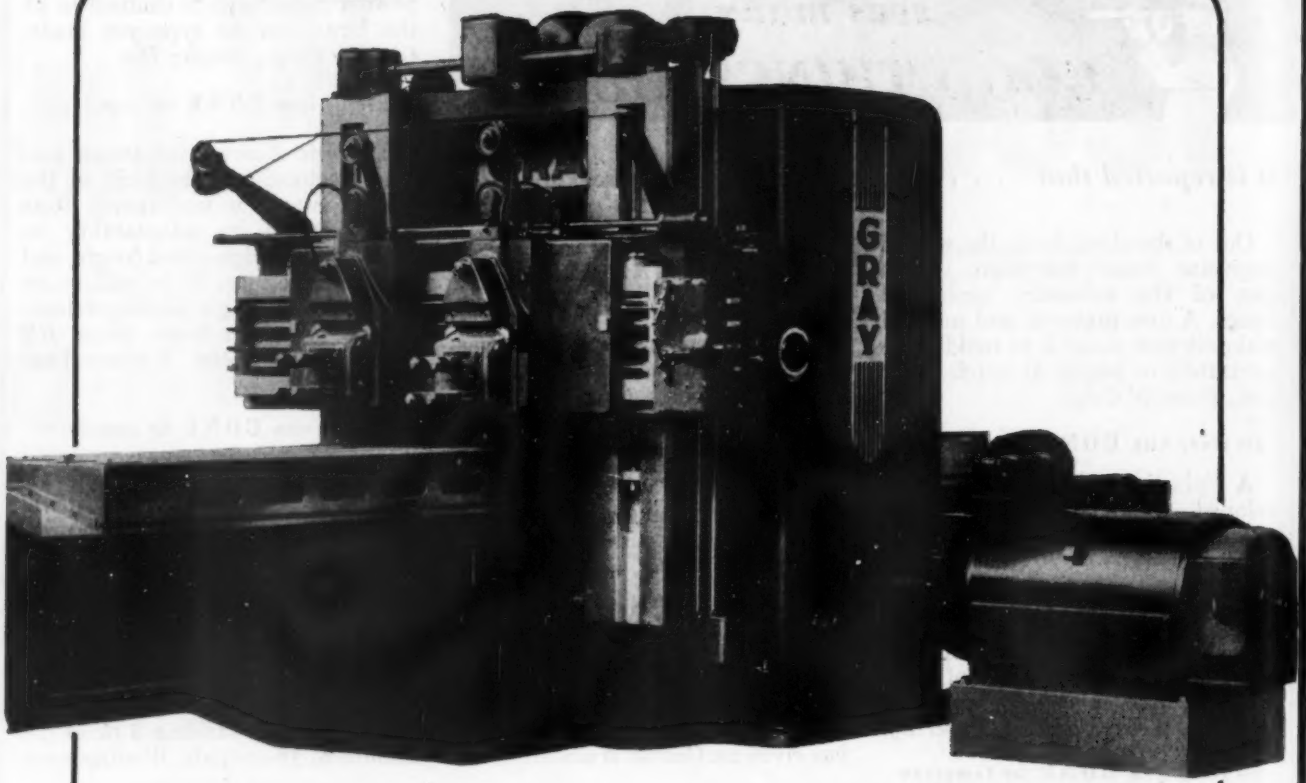
A photographic technique is claimed to be so sensitive that it will record even differences in air pressure such as shock and sound waves or air jets. *Schlieren Method—General Electric.*

get ready with **CONE** for tomorrow

A new dynamometer can stop a 158 ton wheel, whirling 3 miles per minute in 18 seconds. *Westinghouse.*



designed for tough jobs



GRAY die-block PLANERS

Here is the planer for your production of hard, tough die-blocks. This Gray Planer was specifically designed for these jobs. It will face, side plane, and shank die-blocks, in the minimum time. All heads are swivel type, equipped with tool lifters, have power feed, rapid traverse. 50 or 75 H.P. motors.

Write our Engineering Dept. for complete information.

DOUBLE HOUSING and OPERSIDE PLANERS
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SWITCH PLANERS
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DIE BLOCK PLANERS
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MILLING PLANERS
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PLANER TYPE MILLING MACHINES
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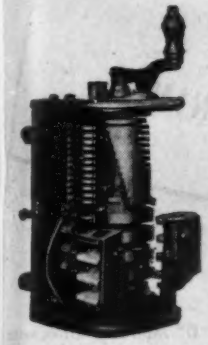
HORIZONTAL BORING MACHINES

The G.A. GRAY Co.

CINCINNATI 7, OHIO, U. S. A.

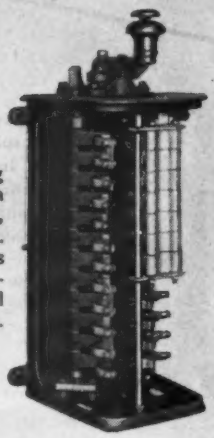
Motor Starters EVERY TYPE,

EVERY SIZE, FOR EVERY MACHINE APPLICATION



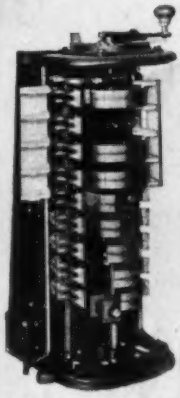
D-C DRUM SWITCH

For use with reversible or nonreversible d-c motors. Recommended where frequent motor starting and stopping and speed adjustment are necessary



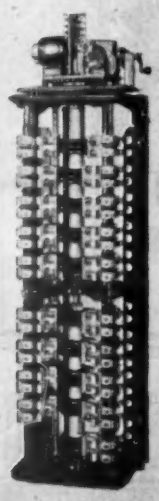
A-C DRUM SWITCH

Suitable for starting or reversing service on small cranes, hoists, machine tools, etc. These drum switches (with primary resistance) will control squirrel-cage motors.



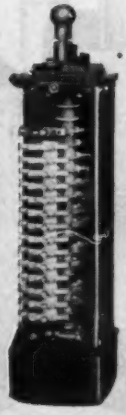
A-C REVERSING DRUM SWITCH

For severe duty controlling large wound-rotor induction motors which operate cranes, hoists, bending rolls, etc.



MOTOR-OPERATED, A-C DRUM SWITCH

Designed either for remote operation or as an automatic control when used with a pilot-circuit device.



DRUM SWITCH FOR SMALL A-C MOTORS

Recommended for starting or reversing small wound-rotor motors—provides dependable operation.

COMBINATION STARTER

6 Ways You Save by Using Combination Starters

1. ***50% reduction in mounting time***—You mount only one device, not two.
2. ***40% reduction in wiring time***—Connect to only 9 terminals, not 15.
3. ***Save ordering time***—Instead of buying two devices, you buy one factory co-ordinated unit.
4. ***Conserve man power***—By eliminating one complete mounting job on every installation.
5. ***Saving of wall space***—The one device takes less space than two.
6. ***Save critical materials***—Combination starters require less wire and steel conduit than separately mounted devices.

WHAT IS YOUR APPLICATION?

G-E starters come in a variety of enclosures to meet any operating conditions. May we send you additional information? *General Electric Company, Schenectady 5, N. Y.*

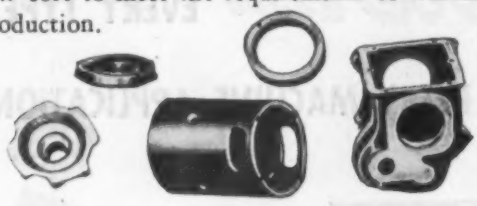
Buy all the BONDS you can—and *keep all you buy*

GENERAL ELECTRIC

670-180C-8910

HOW A BULLARD MULT-AU-MATIC FITS POSTWAR PLANNING

Bullard Mult-Au-Matics over a period of years have been tooled for thousands of different types of work, some of which are shown in the illustrations. Many installations previously on peacetime products were quickly converted at low cost to meet the requirements of wartime production.



Looking now towards reconversion to peacetime needs, prewar or wartime machines will require retooling, and Bullard engineers stand ready to figure your costs for maximum production and efficiency on your postwar jobs. Well-balanced operations and tooling effect a higher degree of Mult-Au-Matic efficiency. Bullard engineers are well versed in this technique and their services are your logical choice.

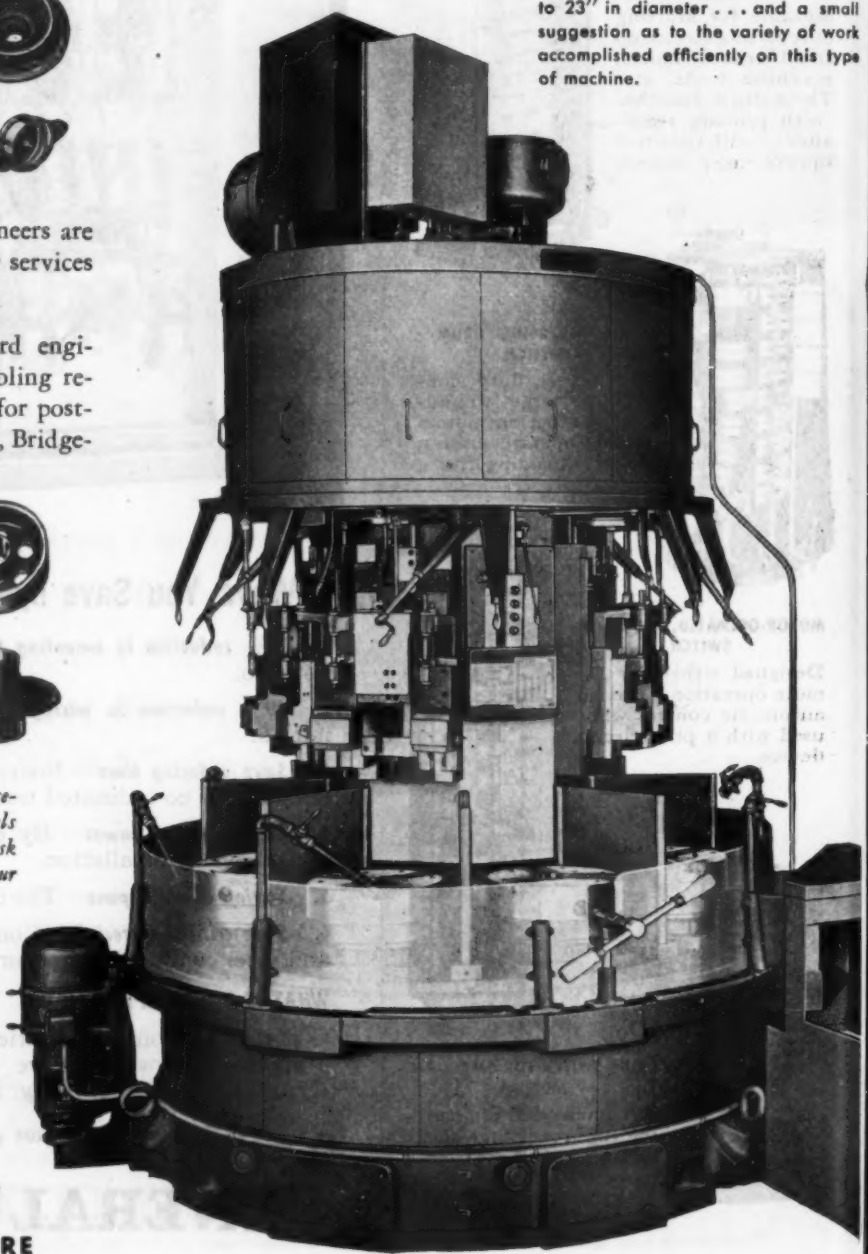
Send blueprints or samples for Bullard engineering time and cost estimates on tooling reconversion. Prepare now and be ready for postwar competition. The Bullard Company, Bridgeport 2, Connecticut.

From Government Machine Tool Surplus Lists select the better machines to replace obsolete models you've been using on non-critical operations. Ask Bullard by serial number for information on your selections.

BULLARD

CREATES *NEW METHODS*
TO MAKE MACHINES DO MORE

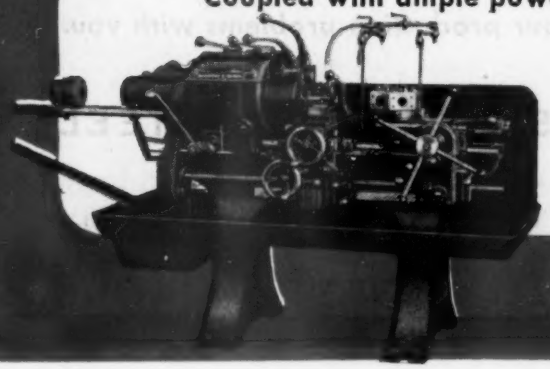
Bullard Type "D" Mult-Au-Matics with 6 or 8 spindles in 4 sizes for work up to 23" in diameter . . . and a small suggestion as to the variety of work accomplished efficiently on this type of machine.



because it handles so easily.

A new (effortless yet powerful) hydraulic spindle brake enhances still further its long standing reputation as the EASIEST OPERATED AND MOST SENSITIVE UNIVERSAL TURRET LATHE.

Coupled with ample power, speed, rigidity, and efficient tooling, the important feature of ease of handling makes this machine an outstanding producer of small parts from bars, forgings or castings.



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J&L STEEL

COLD FINISHED

BESSEMER SCREW STOCK

Uniform Bessemer Flame Control free cutting steel for superior parts.

Our metallurgical engineers will be glad to discuss your production problems with you.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

Call in your secretary . . . tell her to take a letter to Pratt & Whitney engineers. Make a date for them to come out and give you their advice on your tooling problems. They've been giving this service for well over eighty years. They're familiar with all the "ifs, ands, and buts" connected with tooling. Pressing reconversion needs now swiftly follow the demands of war production. Their wartime experience is available to help meet your reconversion needs. P&W engineers will analyze your set-up . . . analyze your problems . . . suggest the solution. It will be a tailor-made job.

Then there's the P&W literature, crammed with helpful ideas, suggestions, and plenty of information. You can go far toward solving your problems by making full use of these extensive catalogs and booklets on Pratt & Whitney's long list of machine tools, small tools, and gages. A letter from you will let us know what we can send that will help you most. Write us today.

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PRODUCTION INSURANCE FOR YOU

★ In 16 years of designing and building tools for Industry, we've learned many things of value to our customers.

For one thing, we've learned the technique of engineering **PEAK PRODUCTION CAPACITY** into every tool we build.

We cut out all needless and expensive frills. Tools bearing our trade-mark are built to **STAY ON THE JOB** of getting work out F-A-S-T!

If you are interested in tools which provide **PRODUCTION INSURANCE,** we invite your inquiry.

QUALITY TOOL & DIE CO.

Manufacturers of "Quality" Products

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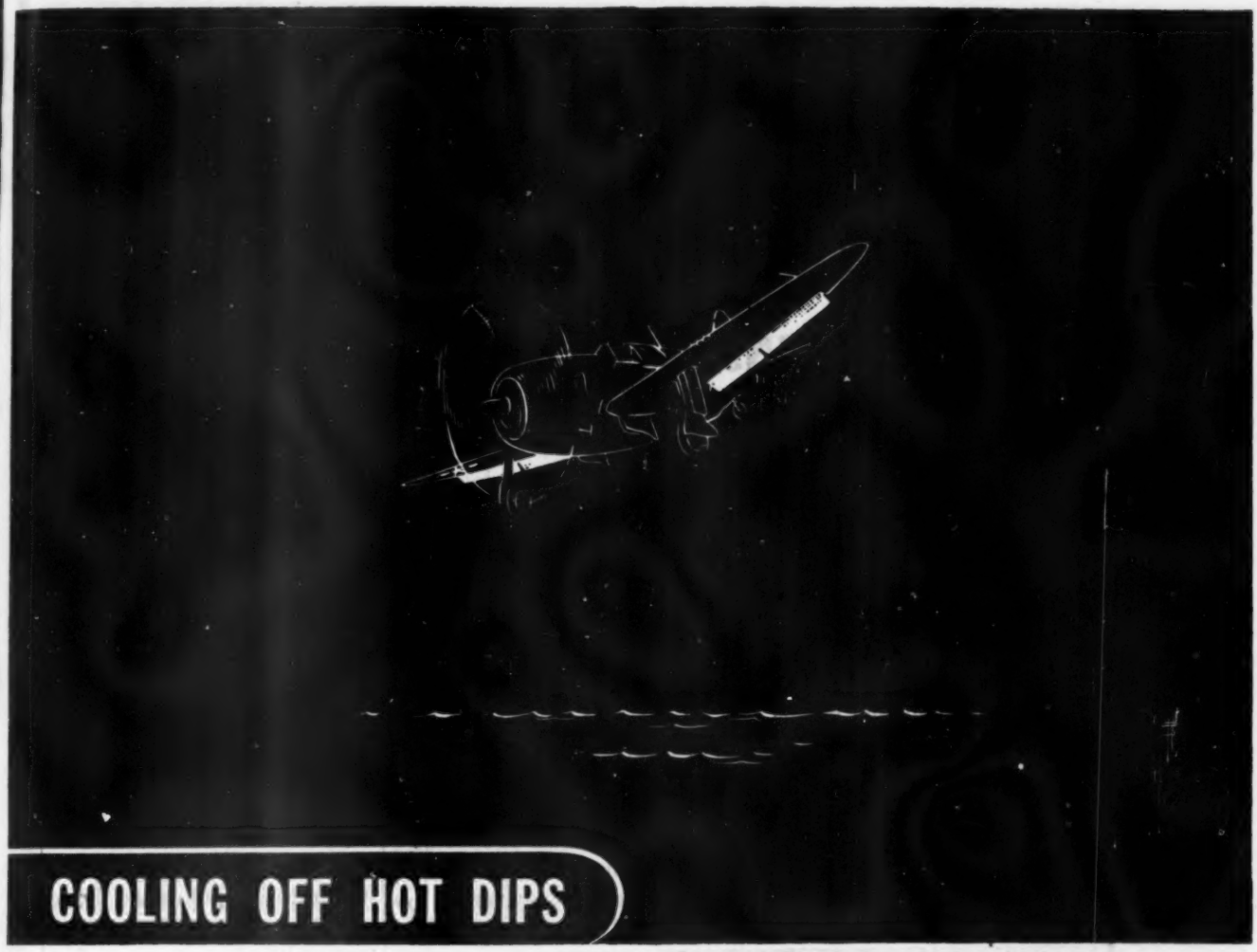

COOLING OFF HOT DIPS

Another result of GE industrial refrigeration

WHEN a fighter pilot dips in for the deck, he's coming in hot... plenty fast... he either cools off speed with wing flaps *down*... or, he's heading for trouble . . .

And the electrolyte in which aluminum—for wing flaps or window sash—is dipped must be cooled off, too... or, there's trouble ahead.

In anodizing aluminum or aluminum alloys, the uniformity of the thin 1/10,000th inch oxide film... its toughness . . . corrosion- and abrasion-resistance . . . strength of primer paint bond... are all dependent, in large measure, on *controlling* bath temperature.

So, here's another important job for G-E Condensing Units! Preventing the electrolyte in anodizing tanks from reaching excessively high temperatures.

And *cooling off hot dips*... in many a chemical or metallurgical processs . . . means smoother, more economical, more efficient production... with fewer bugs popping up to plague operating engineers and management executives.

G-E Condensing Units can be counted on to do a *quality* job . . . to respond to close, automatic temperature control for any liquid. So, if the problem of cooling a fluid is facing you now... or is listed among your postwar projects . . . *turn to G E!*

Our specialized engineering techniques . . . industrial refrigeration and air conditioning experience, skills and research are at your service. You can tap this source—without obligation—by simply writing:

General Electric Company, Air Conditioning Department, Section 5699 Bloomfield, New Jersey.

☆ ☆ ☆

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GENERAL ELECTRIC

Industrial Refrigeration

Tune in: The "G-E HOUSE PARTY," every afternoon, Monday through Friday, 4 p. m., E W T, C B S... The "G-E ALL-GIRL ORCHESTRA," Sundays, 10 p. m., E W T, N B C... "THE WORLD TODAY" News, Monday through Friday, 6:45 p. m., E W T, C B S

NOW IT CAN BE TOLD

Accuracy in "Millionths" on Production Job Obtained on Bryant No. 112 Internal Grinders

B-29 FUEL INJECTION PUMP PRODUCED BY ECLIPSE

SPRINGFIELD, VERMONT — Another stride by American war production genius was disclosed recently by the Army Air Forces Air Technical Service Command and Eclipse Machine Division of Bendix Aviation Corporation.

Mass production of fuel injection pumps for the B-29 Superfortress has been achieved at the Eclipse plants in Elmira, New York. The Bryant No. 112 Internal Grinder was chosen for the sleeve bushing job, and technical details for production of this part were worked out through the close cooperation of Eclipse and Bryant engineers.

Production Tolerances Unbelievable

In the hands of Eclipse workers, the Bryant machines are producing parts to diameter *tolerances of 10 millionths of an inch or less.* This necessitates maintenance of straightness and roundness to even finer tolerances. This infinitesimal degree of precision was graphically demonstrated by Mr. T. W. Tinkham, General Manager of the Eclipse Machine Division. After demonstrating the precise fit between the plunger and the bushing ground on the Bryant machine, Mr. Tinkham had a newsman rub his fingers on the pump piston. The very slight film left by the newsman's fingers was sufficient to make the plunger stick in the bushing.

Improves Bomber Performance

B-29's equipped with the fuel injection pump are flying surer than ever before at extreme altitudes where rarefied atmosphere, varying pressures and sub-zero temperatures must be taken into account. It is interesting to note that the gasoline is the only lubricant used in the pump assembly.

Cooperation Plus Secrecy

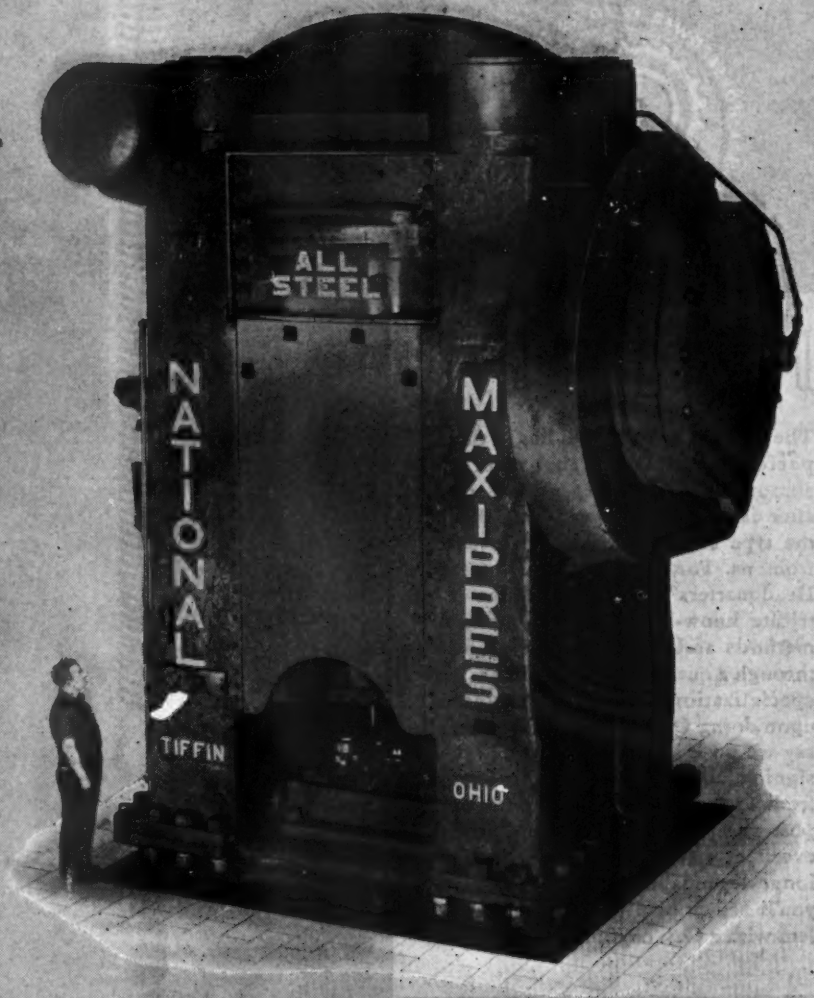
This is a typical example of the way Bryant men have cooperated with the engineers of our leading manufacturers during the war years. This is one example, but hundreds of others still must remain on the secret list. Now, when you are planning for a peacetime production there still is a Bryant man ready to assist you.

(*Photo Courtesy Eclipse Machine Division*)

MACHINES THAT DO THE JOB. This is part of the group of over a hundred Bryant internal grinders at Eclipse Machine Division, Bendix Aviation Corporation, Elmira, New York. These machines are grinding sleeve bushings to a tolerance of 10 millionths or less.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

A NEW MAXIPRES



The above photo shows the new National No. 7½ High Speed Forging Maxipres—weight 800,000 pounds—the World's largest.

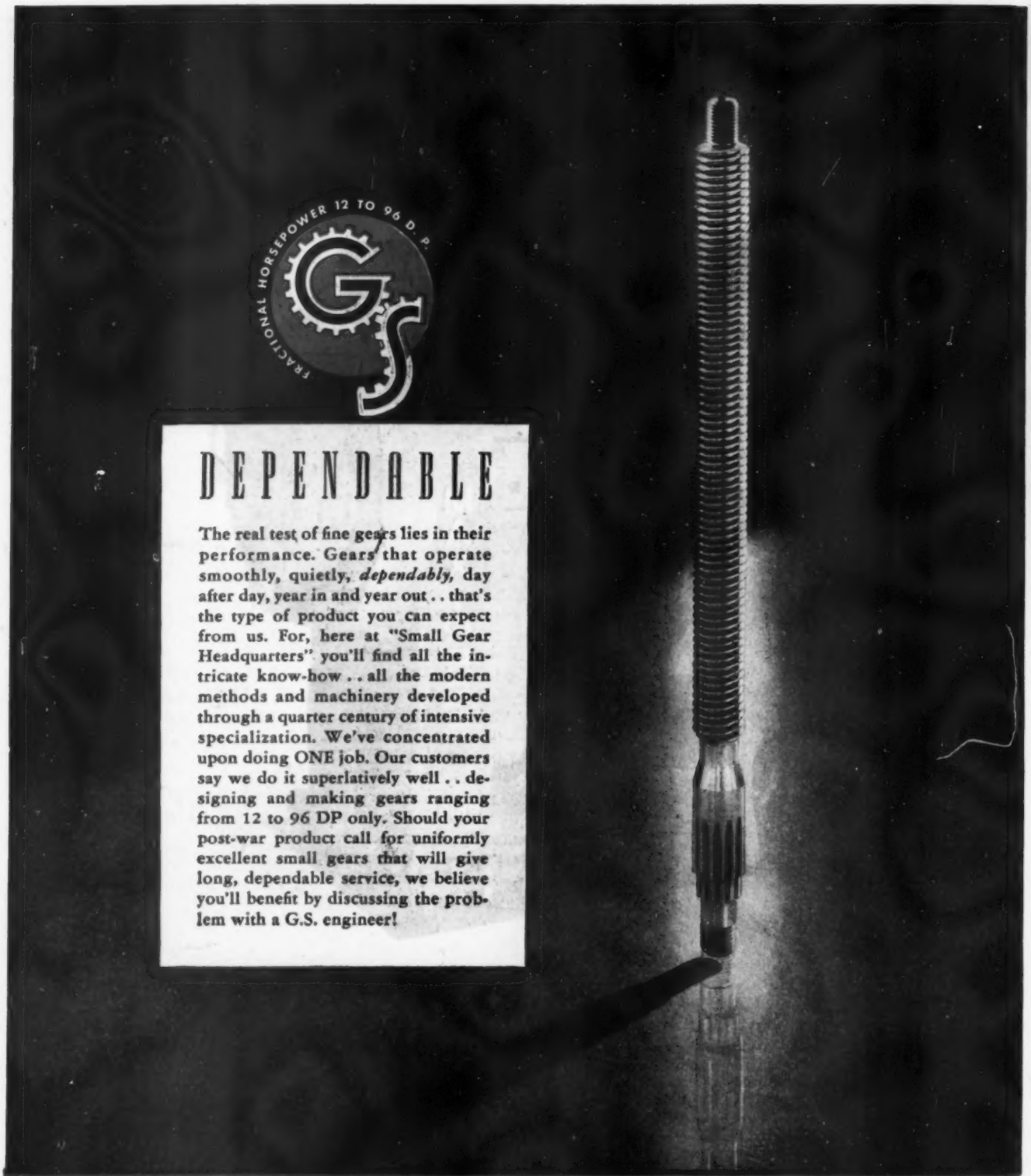
This machine operates at a speed of 50 strokes per minute, and produces in one blow, in each die impression, the size of forgings normally handled on an 8,000 pound steam hammer.

Large wheel hubs, gear blanks, pipe flanges, crankshafts, cylinder heads, connecting rods, side bar links, bearing races, and a wide variety of similar work will be regular peace time jobs for this machine.

It will pay you to fully investigate Maxipres Forging. Tell us the nature of your forging work, and we will send complete details.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

New York Detroit Chicago



DEPENDABLE

The real test of fine gears lies in their performance. Gears that operate smoothly, quietly, *dependably,* day after day, year in and year out . . that's the type of product you can expect from us. For, here at "Small Gear Headquarters" you'll find all the intricate know-how . . all the modern methods and machinery developed through a quarter century of intensive specialization. We've concentrated upon doing ONE job. Our customers say we do it superlatively well . . designing and making gears ranging from 12 to 96 DP only. Should your post-war product call for uniformly excellent small gears that will give long, dependable service, we believe you'll benefit by discussing the problem with a G.S. engineer!

FRACTIONAL HORSEPOWER 12 TO 96 D. P.

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

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WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

Van Keuren

THREAD MEASURING WIRES

STANDARD EQUIPMENT EVERYWHERE

Van Keuren measuring wires are the accepted standard equipment for making measurements on thread gages, taps, worms, splines and spur gears. We carry a complete stock of sizes for measuring U. S. Standard, Whitworth, Metric, British Association, Pipe, Acme and 29° Worm threads. Special wires of any diameter in the range from .002" to 1.5708" are made to order. Our large supply of blanks insures prompt delivery.

Van Keuren thread measuring wires are manufactured to National Bureau of Standards specifications. They are hardened, ground and lapped by precision methods developed over a quarter-century. They are accurate within .00002" for roundness and straightness and within ±.000025" for size. Special sizes are made to any tolerance required.

It is easy to use Van Keuren wires. The Van Keuren handbook, — "Precision Measuring Tools" gives complete tables and simplified formulas for measuring all standard threads, splines and spur gears. Send for this valuable 160 page handbook No. 33.

Van Keuren

25 YEARS

WHAT IS YOUR ULTIMATE MANUFACTURING RESPONSIBILITY?

DEVELOPMENT?

ENGINEERING

SERVICE?

PRODUCTION?

Isn't it Distribution?

All of the intended benefits and usefulness of your product—the brain-beating which conceived and fashioned it; the sweat, toil and risk-taking which produced it—depend upon your determination to put improved quality products into the hands of the most users at the lowest possible price. The ultimate success of your enterprise depends on balanced, economical distribution of its results.

Production economy is usually considered a necessary first step in distribution economy; and, in view of the recently increased rate of technological development, it is logical first to explore all possibilities for maintaining low unit costs of production. With probable higher labor costs ahead of us, it is evident that we can attain low production cost per man-hour only through improved machinery, improved methods of processing and improved methods of distribution.

Micromatic Microhoning—the newest desirable, high production method of final precision machining of cylinder bores—has already made substantial

improvements in quality, and cost reductions in a wide range of products in the automotive, aircraft, diesel, refrigeration, compressor, anti-friction bearings and other manufacturing industries. It can remove a large amount of metal without damaging the subsurface structure; it has eliminated one or two steps in the final processing of cylinder bores in many parts.

In this processing, a tool carrying several abrasive sticks is revolved while also being stroked in a simple or compound reciprocating motion. Applicable to internal and some external cylindrical surfaces, it removes metal at rates ranging up to .008 to .010 on diameter per minute; and in quantity up to .070 to .080 on diameter, or volume as high as 75 cubic inches per hour. It corrects errors of previous processing and generates true roundness, bore wall and axial straightness in a majority of applications within tolerances ranging from .0001 to .0005. It is available with automatic size control which holds size uniformity within .0001 to .0003 in high production.

MICROMATIC HONE CORPORATION

DETROIT 4, MICHIGAN

MICRO MATIC

FUNDAMENTAL TO LOWER COST, VOLUME PRODUCTION ARE MODERN TOOLS SUCH AS

MICROMATIC HONING MACHINES

Industry after the war will need modern production tools as much as it will need modern distribution methods. Micromatic Honing Machines have developed rapidly to ultra-modern, high speed tools for final precision machining.

MICROMATIC MODEL 705 MULTIPLE SPINDLE VERTICAL HYDROHONER

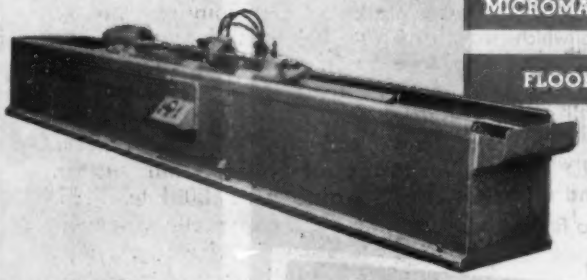
with built-in automatic Microsize Control. For internal honing. Rotary indexing work table provides high production. Usually recommended for maximum stock removal ranging from .0005" to .0015" on hardened parts—.001" to .010" on soft or medium hard. Bores from ¼" to 2" diameter. Microsize control gauges work automatically. Work is held uniformly within tolerances of .0003". Honing cycle is automatically stopped when correct size is reached.

MICROMATIC MODEL 702 VERTICAL HYDROHONER

Standard single spindle type—built for rapid production honing of bores or cylindrical surfaces up to 2" in diameter.

MICROMATIC HORIZONTAL FLOOR TYPE HYDROHONER

for internal or external honing. Tool operates either under hydraulic or manual control. Tools available to generate either crosshatch or co-directional finish patterns. Full floating tool action. Stock removal .0015" to .002"—precision generated size limits .0003". Corrects error for taper to within .0001" limit. Size of work accommodated 1" up.



MICRO MATIC

MICROMATIC HONE CORPORATION

DETROIT 4, MICHIGAN

DISTRICT OFFICES: 614 Empire Building, 808 South Main St., Rockford, Illinois • 129 Church St., New Haven 10, Connecticut
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TWO HEADS ARE BETTER THAN ONE IN MULTIPLE PRECISION GRINDING

When Fitchburg engineers put their heads to the "grindstone" to develop a method that would cut costs on precision grinding as multiple tooling has on machined work, they emerged with a revolutionary idea. This new design not only makes other equipment obsolete — it also prevents its own obsolescence by its unique engineering feature!

The basis of this Fitchburg method is an independent standard interchangeable grinding head which may be mounted singly or in multiples on standard or special equipment, and may be regrouped and remounted on standard machines or on new special bases, for operations other than the one originally specified. Mounted singly, it can perform more jobs than was thought previously possible — straight or bevel gears, internal or external gears, etc. — due to its independent positioning and its ability to be set at any angle the work requires. Mounted in multiples, its production uses are even greater.

THE HEAD. *The Bowgage Head* is a completely independent precision grinding unit. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position — all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed.

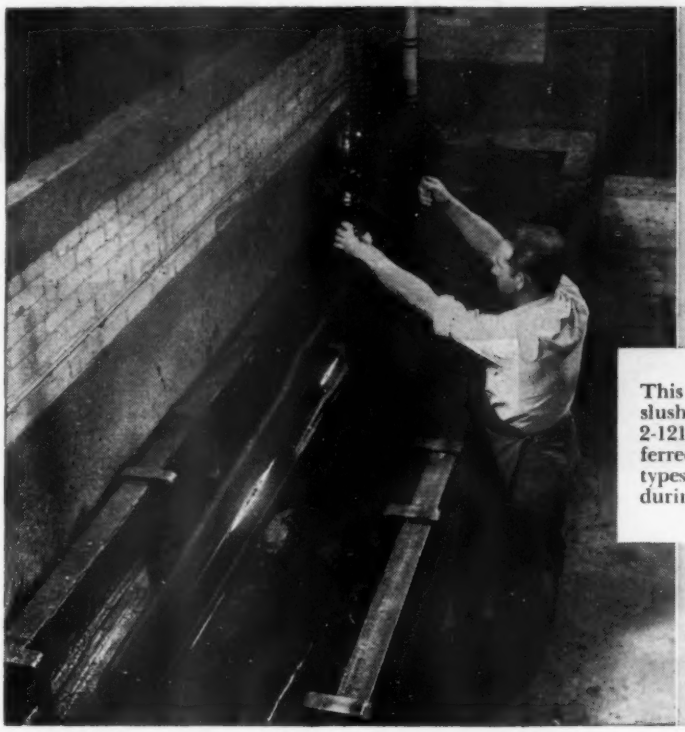
THE BODY. *This Fitchburg Double-Head Grinder and Polisher for Gear Shift Grooves* is typical of many special Fitchburg machines into which independent Fitchburg heads can be built to cut costs through multiple automatic grinding on mass production. One grinding wheel rapidly traverses into the slot and then an automatic side wheel motion grinds one side of the slot, then the other. Meanwhile, the other grinding wheel comes in and finish-polishes the first side ground, then the second side which has just been ground. This is an automatic cycle from start to finish.

Write Today for Catalog—Sent Free Upon Request

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders.



This tube for a 105-mm. howitzer is being slushed with Gulf Rust Preventive Compound 2-121. Gulf quality rust preventives are preferred by many war plants for protecting all types of metal parts and military equipment during storage and transportation overseas.

Protect your surplus tools and equipment with GULF QUALITY RUST PREVENTIVES ...a complete line to meet your every need!

RECONVERSION time is rust-prevention time! Act now to be ready for prompt rust-proofing of yours as well as Government-owned tools and production equipment.

From Gulf's complete line, you can select one or more war-proven rust preventives that will meet your every requirement for both interior and exterior use—and provide positive protection for indefinite periods.

Gulf quality rust preventives have given an excellent account of themselves in protecting all types of metal parts and war equipment during storage and transportation overseas. They meet Government specifications for exterior and interior application, and are available now for immediate delivery.

For further information on Gulf quality rust preventives, write, wire, or phone your nearest Gulf office.

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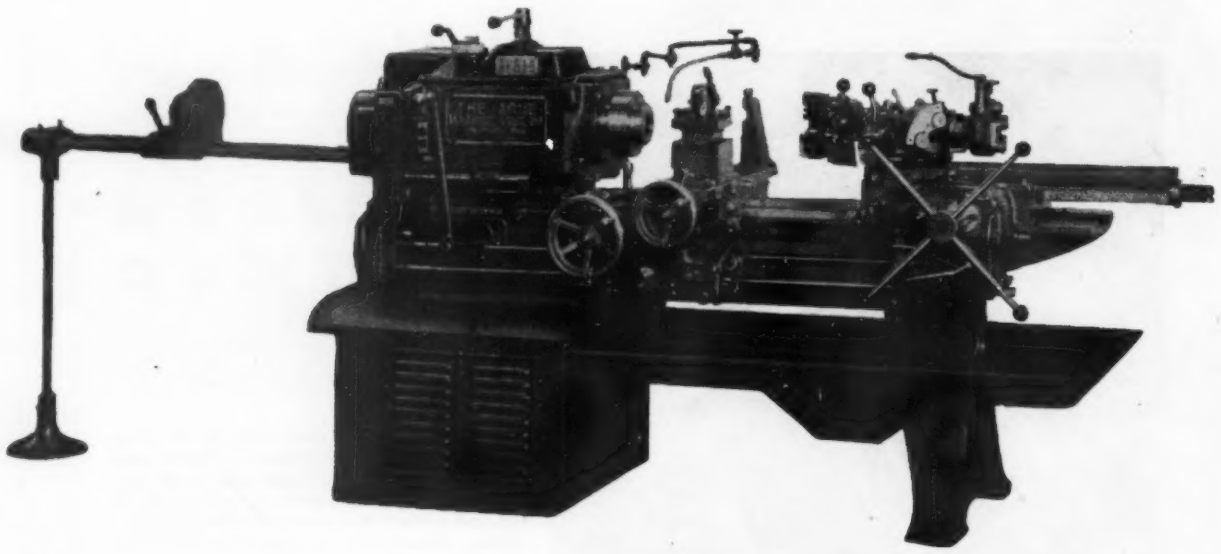
GULF INDUSTRIAL LUBRICATION



ACME

RAM TYPE FOR BAR WORK

● This Acme Ram Type Turret Lathe is fitted with Automatic Chuck and screw bar feed. It is also equipped with chasing attachment for cutting from 4 to 32 threads per inch. This attachment is extra and furnished only when required.

This type machine will accommodate round bar stock up to 2" on the No. 5R machine, and up to 2½" round stock on the No. 6R machine.

All of the most important features necessary to maintain accuracy and speed at low cost are incorporated in this design which includes:

Hardened steel vees on bed.
Hardened steel ram slide bearings.
Triple roller spindle bearings.
Twin nut back lash eliminator on cross screw.
Non-overhanging headstock.
Side carriage apron taper gibed to front bearing on bed.
Independent feed ranges for either apron.

These are only a few of the many features.

For further details, or if you have any problems on bar or chucking work, feel free to contact us.

...The ACME MACHINE TOOL CO.
... CINCINNATI 32, OHIO.

TWO SEPARATE OPERATIONS.....
IN THE TIME REQUIRED FOR ROUGH MILLING — *ALONE*

The NEWTON MILL-N-SHAVER

COMBINATION UNIT HEAD MILLING AND SHAVING MACHINE EQUIPPED WITH TWO SINGLE VERTICAL MILLING HEADS AND TWO FINISH SHAVING HEADS. HYDRAULIC FEED TO TABLE.

The Newton Mill-N-Shaver performs two complete operations at one pass of the table. It rough mills at milling speed and finish shaves on the return, at the rapid traverse speed. This machine produces a perfect gasket surface . . . two separate operations . . . in exactly the time ordinarily required for rough milling alone. The Newton Mill-N-Shaver is designed to both step-up your production and reduce your costs on the types of work for which this machine is adapted. For detailed information, write for Bulletin No. 580.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION
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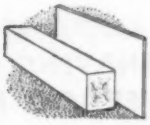
Low Speeds FOR METAL!

High Speeds FOR WOOD!

YOU GET BOTH IN

Walker-Turner

14-16 INCH BAND SAWS



Walker-Turner 14" and 16" Band Saws are equipped with back-gearing and cone pulley. This enables the operator to select correct low speeds for metal-working. By simply throwing a lever and engaging a pin, the gear train is disconnected and the Band Saw converted into a direct drive machine—with higher speeds for non-ferrous metals, plastics and wood.

Walker-Turner Band Saws have a speed range from 61 to 5300 s.f.m. Blade tensioning devices have spring cushions to absorb shocks. Heavily-ribbed, carefully-machined tables tilt to 45°. Send today for latest catalog.

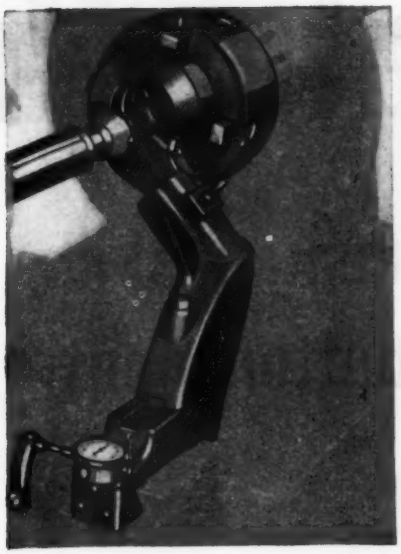
PRICE
(with gear unit)
$127.50
(less base and motor)
F.O.B. Plainfield
(slightly higher west of Rockies and Canada)

WALKER-TURNER COMPANY, Inc., PLAINFIELD, NEW JERSEY

walker-turner
COMPANY, Inc.
PLAINFIELD, N.J.
U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

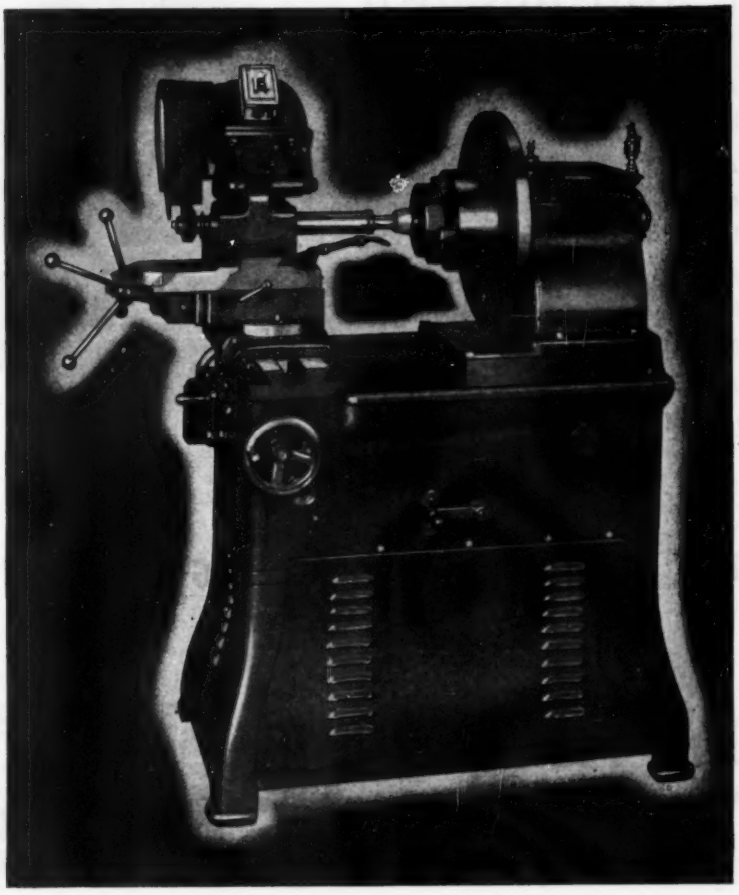


EXCLUSIVE AUTOMATIC SIZER ON THE NEW

LEMPCO

MODEL ACX INTERNAL AND SURFACE GRINDER

Mechanical sizing device insures precision work—even from new hands—duplicates successive pieces exactly; eliminates spoilage; saves valuable man-hours. Rapid and easy change-over from turn to grind; work-head adjustable for various size jobs; 18" swing; screw and rack and pinion infeed. Many other important and exclusive features. Write today for illustrated and detailed circular. Good delivery.



★ ***AUTOMATIC POWER CROSS-FEED***

★ ***FOR INTERNAL • EXTERNAL SURFACE • TAPER JOBS***

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Automatic Precision

. . . beyond human skill with push-button control

The Model 3-B JIGMIL

PROVIDES accuracy beyond human skill by push button control.

Automatic positioning between holes is controlled to within less than one ten-thousandth part of an inch.

Retraction and repositioning of the work for measuring or tool changing is by push button operation.

Any function is responsive to this centralized finger tip control.

The World's Finest BORING and Milling Machine

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announces

A 12-PART TALKING SLIDEFILM COURSE in INDUSTRIAL ELECTRONICS

VISUALIZED for easy understanding, even by non-technical people

PACKAGED for easy instruction, using your own "home-talent" leaders

PRACTICAL up-to-the-minute subject matter, technically authentic

NOW, an understanding of electronics as applied in industry can be built up, right within your organization, using the ingenious new techniques of *visual instruction* that have proved so successful for wartime training. Every sequence of this 12-part course has been put to test on groups of widely different education levels. Educators have joined practical plant executives in praising its combination of *easy understanding* and *technical accuracy.*

As you follow the instruction manual, the sessions almost "conduct themselves," so that no great experience in organizing or instructing people is necessary. Everything essential is furnished except a sound slidefilm projector (35 mm, 33⅓ rpm), screen, and a meeting place. Upon completion of the course, your people will have a well-rounded acquaintance with electronic devices, tubes, circuits, and applications.

HERE'S WHAT YOU GET

12 Slidefilms and Recorded Talks — each about ½ hour long

300 Review Booklets — 25 sets of 12 individual lessons, keyed to the slidefilms

1 Instructor's Manual — a 140-page book with hundreds of illustrations and detailed steps for conducting the course

1 Carrying Case — attractive and strongly built, it holds records, films, and manuals

The Price — for the complete "package" as above, $100; *extra* manuals, $3; *extra* sets of 12 review booklets, $2

Orders — can be placed through any local G-E office, or use the coupon below. (Course may be returned without charge if you are not fully satisfied.)

ALL THESE WILL BENEFIT

PLANT ELECTRICIANS and maintenance men will find the course understandable, even if their knowledge of electrical theory is limited.

PLANT AND DESIGNING ENGINEERS will find it stimulating in suggesting electronic applications to improve products or processes.

SALESMEN selling electronic products will be better equipped to talk to their customers.

EXECUTIVE MANAGEMENT and purchasing agents will be in a better position to consider and approve recommendations involving electronic equipment.

PRODUCTION MANAGERS and foremen will get a clearer concept of the workings of equipment for which they are responsible.

THESE ARE THE 12 SUBJECTS OF INDIVIDUAL FILMS AND LESSON BOOKS

1. Harnessing the Electron
2. Electronic Tubes as Rectifiers
3. Grid Control of Electronic Tubes
4. Fundamentals of Electricity, Part I
5. Fundamentals of Electricity, Part II
6. Electronic Relay Systems
7. Electronic Rectifier Equipment
8. Thy-mo-trol (Thyratron Motor Control)
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11. Photoelectric Systems
12. Electronics, Today and Tomorrow

GENERAL ELECTRIC

Buy all the BONDS you can—*and keep all you buy*

GENERAL ELECTRIC COMPANY
Apparatus Dept., Section H685-14
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☐ Enclosed is our order for.....complete INDUSTRIAL ELECTRONICS courses at $100 each.

☐ When could someone in our organization examine the complete kit?

Name.....

Company.....

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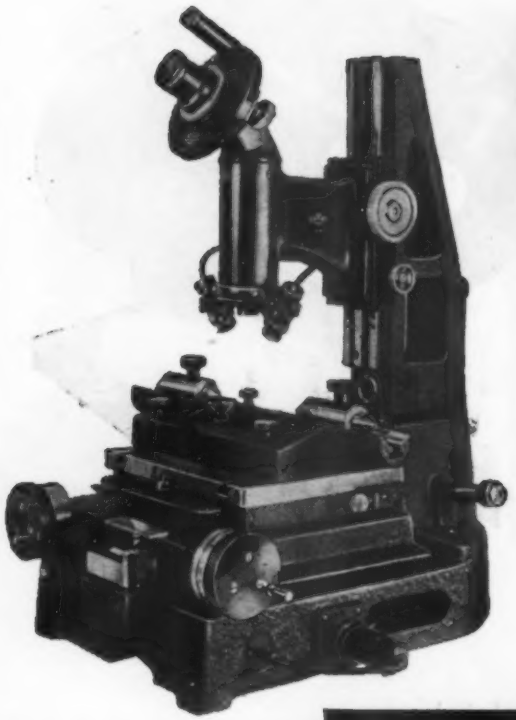


The TOOL MAKER'S MICROSCOPE

. . . a universal inspection instrument for every shop

Its wide application in toolroom as well as gage or tool inspection results from the fact that this instrument combines both an OPTICAL COMPARATOR and a UNIVERSAL MICROSCOPE for measurements in two linear dimensions 4" x 2" and angular dimensions in degrees and minutes.

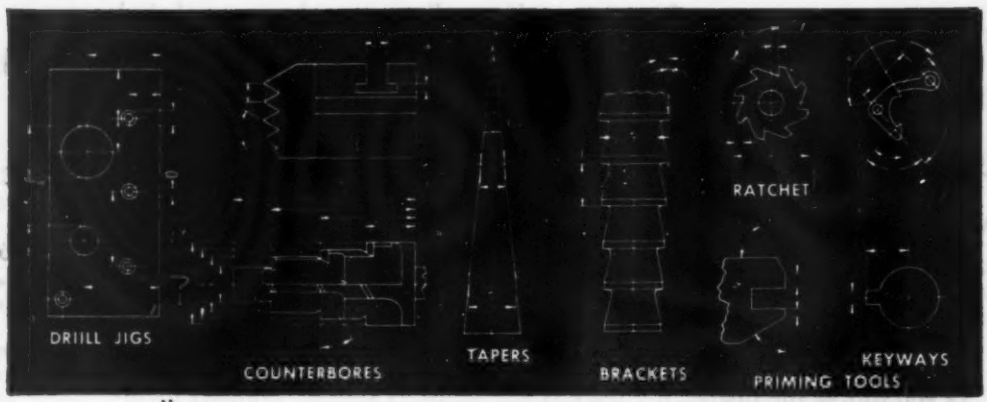
Its use will guarantee superior accuracy because of the unique principle of performing both comparative checking and direct measurement on a 30x magnified image of highest definition in the eyepiece—not an open screen. Measurements can be readily duplicated within .0001" by precision micrometers or within closer limits by gage blocks. The toolmaker microscope is economical to use since the making of expensive scale drawings required for other optical methods is entirely eliminated and an enormous amount of time is saved over ordinary measuring and layout practices involving height gages, indicators, gage blocks, protractors, toolmakers buttons, etc.

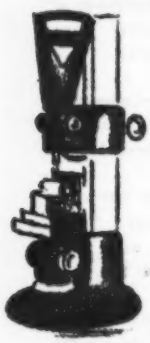
Other Instruments in the

SCHERR

Limited Budget

INSPECTION LABORATORY





SCHERR COMPARITOL

SCHERR MAGNI-RAY

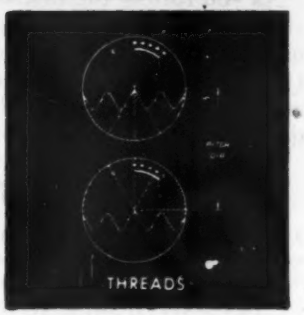
TYPICAL APPLICATIONS

CHECKING AND INSPECTION—Work in progress, finished work, form tools, milling tools, drill jigs, templets, gauges, machine parts, taps and hobs, keyways, tapers, ratchets, pawls, etc.

THREAD MEASUREMENTS—Diameter, form, angle, depth, lead, external and internal root diameter.

ALSO—Length, coordinate and angle measurements.

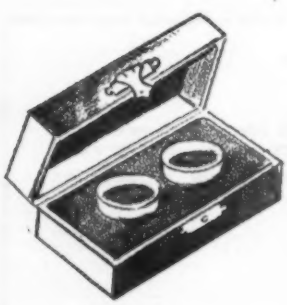
Send for Complete Details



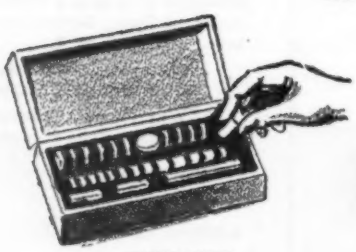
GEORGE SCHERR CO.

INCORPORATED

201 LAFAYETTE STREET NEW YORK 12, N. Y.

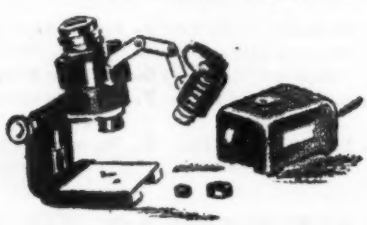


OPTICAL FLATS

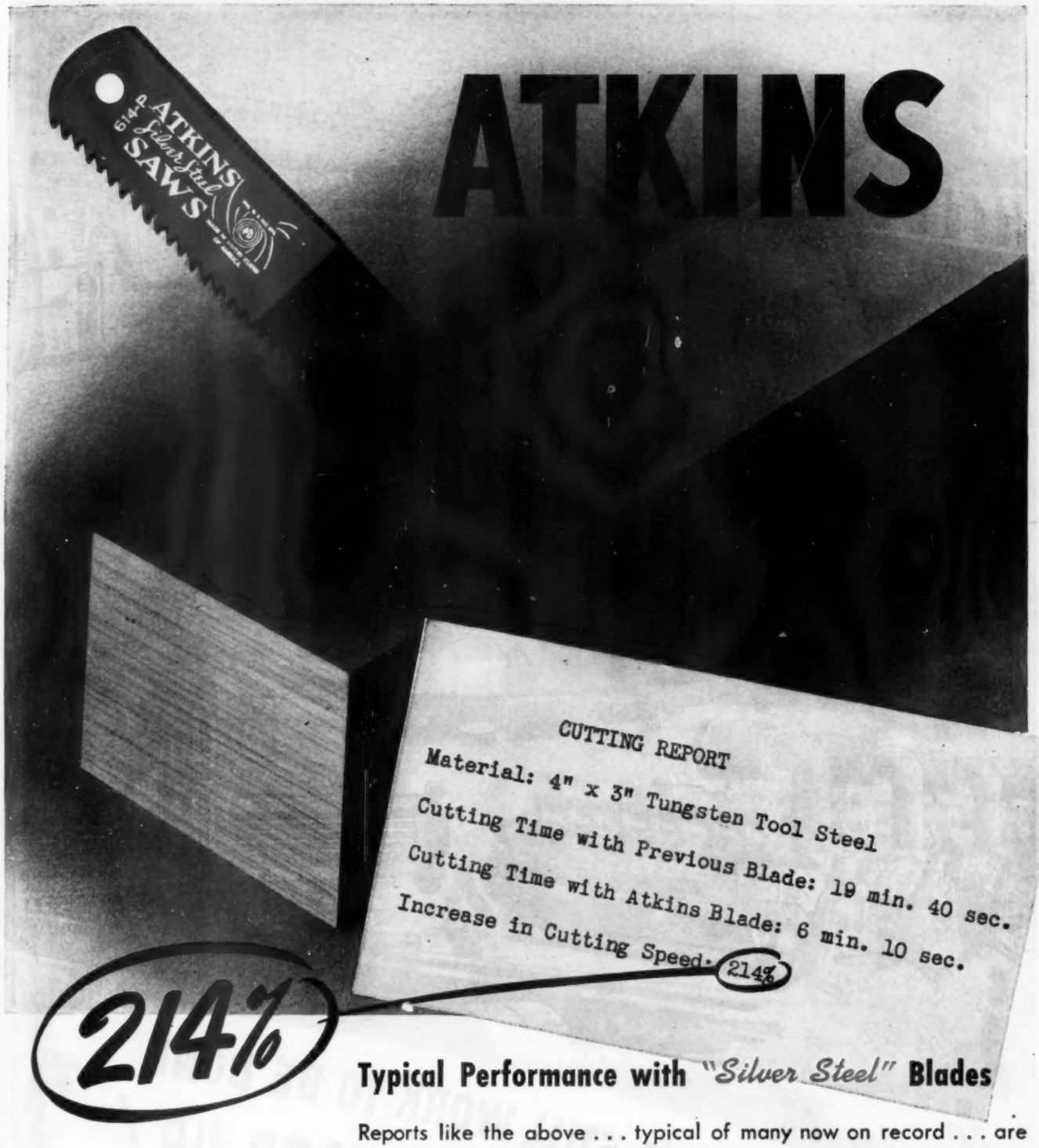


ULTRA-CHEX INSPECTOSET

WILDER PROJECTOR



SPENCER BINOCULAR MICROSCOPE



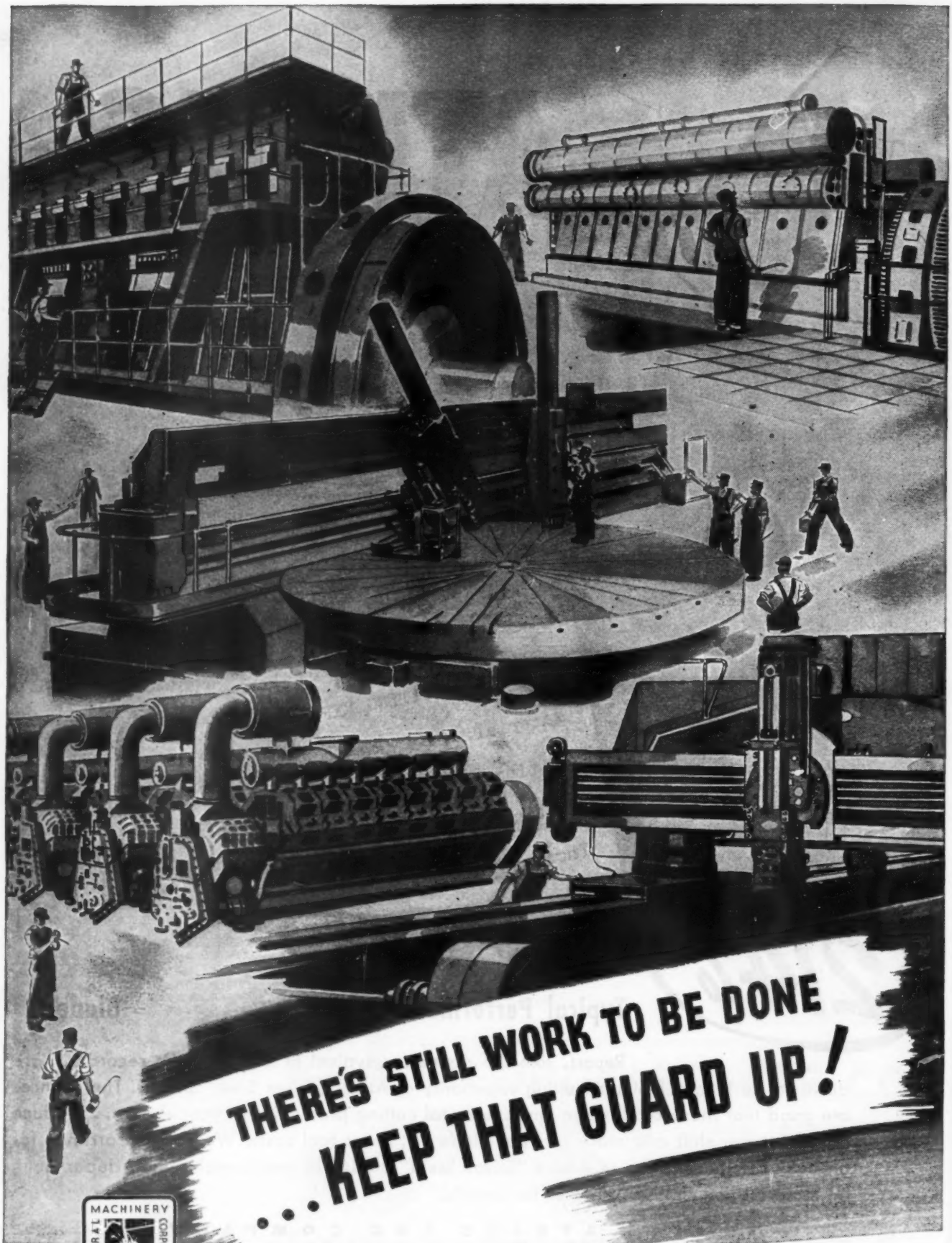
Typical Performance with *"Silver Steel"* Blades

Reports like the above . . . typical of many now on record . . . are down-to-earth proof of the cutting superiority of Atkins "Silver Steel" Blades. The chances are good that these blades can improve metal cutting production in your shop . . . produce more cuts per shift and more cuts per blade . . . lower tool costs. We'll gladly arrange for an actual demonstration of Atkins "Silver Steel" Blades in your metal cutting department, on material you choose. Write us for details.

E. C. ATKINS AND COMPANY
424 South Illinois Street, Indianapolis 9, Indiana
Agents and Dealers in all Principal Cities the World Over

ATKINS

MANUFACTURERS OF BETTER SAWS FOR EVERY CUTTING JOB
Power and Hand Blades • Milling Saws • Segmental Cold Saws • Metal Cutting Bands



GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS COMPANY • THE HOOVEN, OWENS, RENTSCHLER CO. • GENERAL MACHINERY ORDNANCE CORPORATION

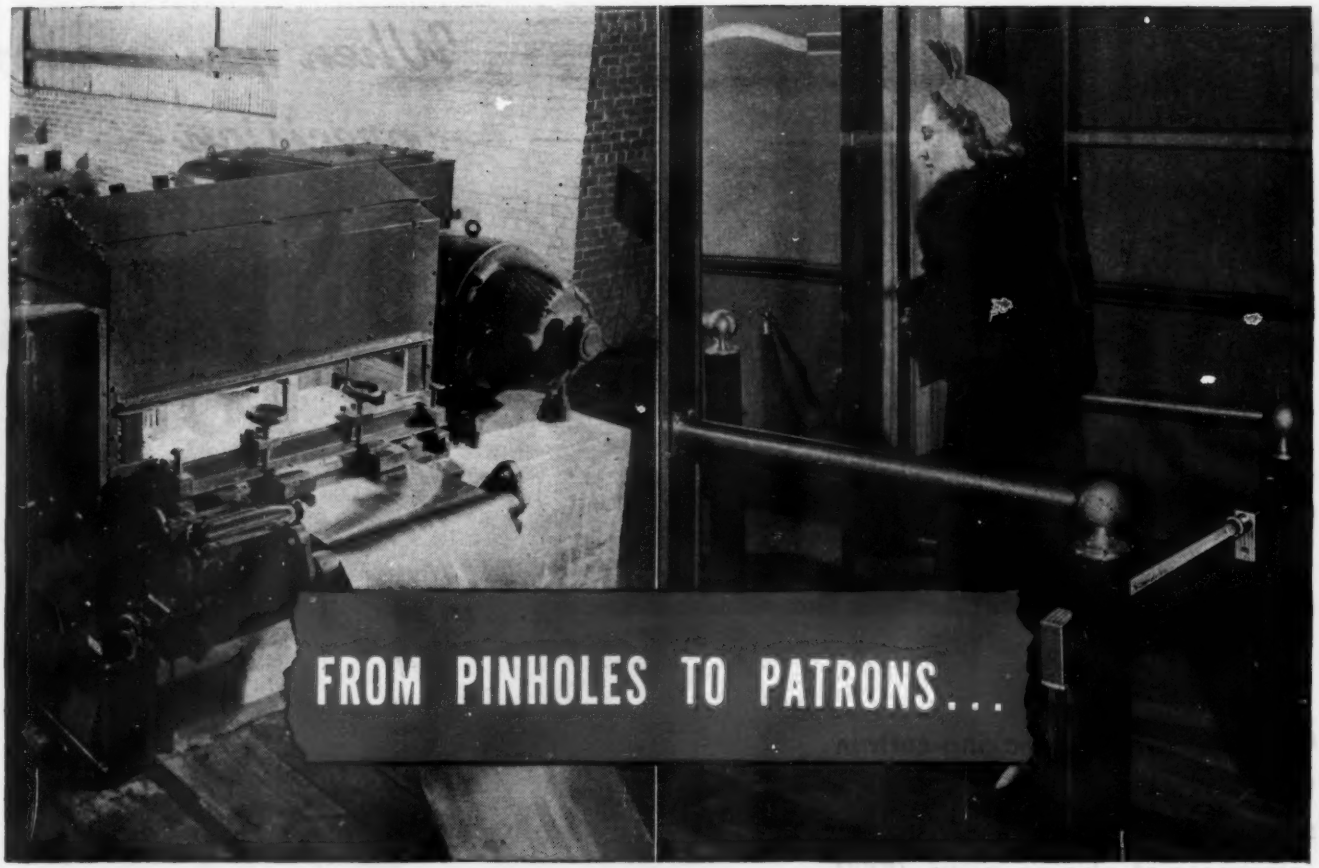
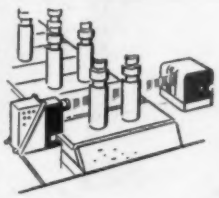
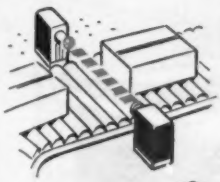


PHOTO-TROLLERS SOLVE PROBLEMS OF CHECKING . . . COUNTING . . . AND CONTROLLING IN A "WINK OF THE EYE"



QUALITY CONTROL

Photo-Trollers can be used in such varied control applications as thread-break detection, cloth guiding and conveyor regulation.



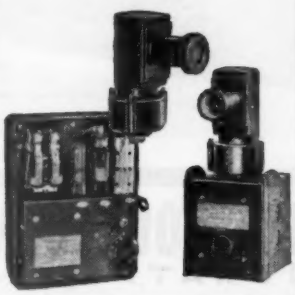
AUTOMATIC COUNTING

Counting patrons or products quickly and accurately is easy with the Photo-Troller.

PERSONNEL PROTECTION

Operators of hazardous machines are protected by the Photo-Troller activating a stop switch when the operator is in the danger area.

Photo-Troller units are sturdy, long-lived and compact. A Photo-Troller installation consists of a light source and the phototube mounted either in a control cabinet or a separate housing.



The Photo-Troller is the dependable solution to problems in many diversified applications . . . simplifying inspections, speeding operations, and replacing slow and inaccurate procedures. Used, for example, to inspect the tin-coated strips of steel used for making cans, the Photo-Troller detects "pinpoint" imperfections while the strip travels 1,000 feet per second, signaling a warning when a hole with a diameter as small as $\frac{1}{64}$ inch is spotted. With the same ease and accuracy the Photo-Troller can count patrons who enter or leave an establishment . . . open doors . . . operate protective devices . . . wrappings . . . or inspect products for size and weight.

These are only a few of the many uses of the Westinghouse Photo-Troller, the photoelectric "eye" operated by partially or completely breaking a light beam. Photo-Trollers are designed for indoor or outdoor use, for varied rates of operation and degrees of sensitivity, and for operation under conditions of dampness, dust and corrosive atmospheres. Installation and adjustment are easy, and both first costs and maintenance costs are low. For complete information about the Photo-Troller and help in applying it to the solution of your problems, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60569

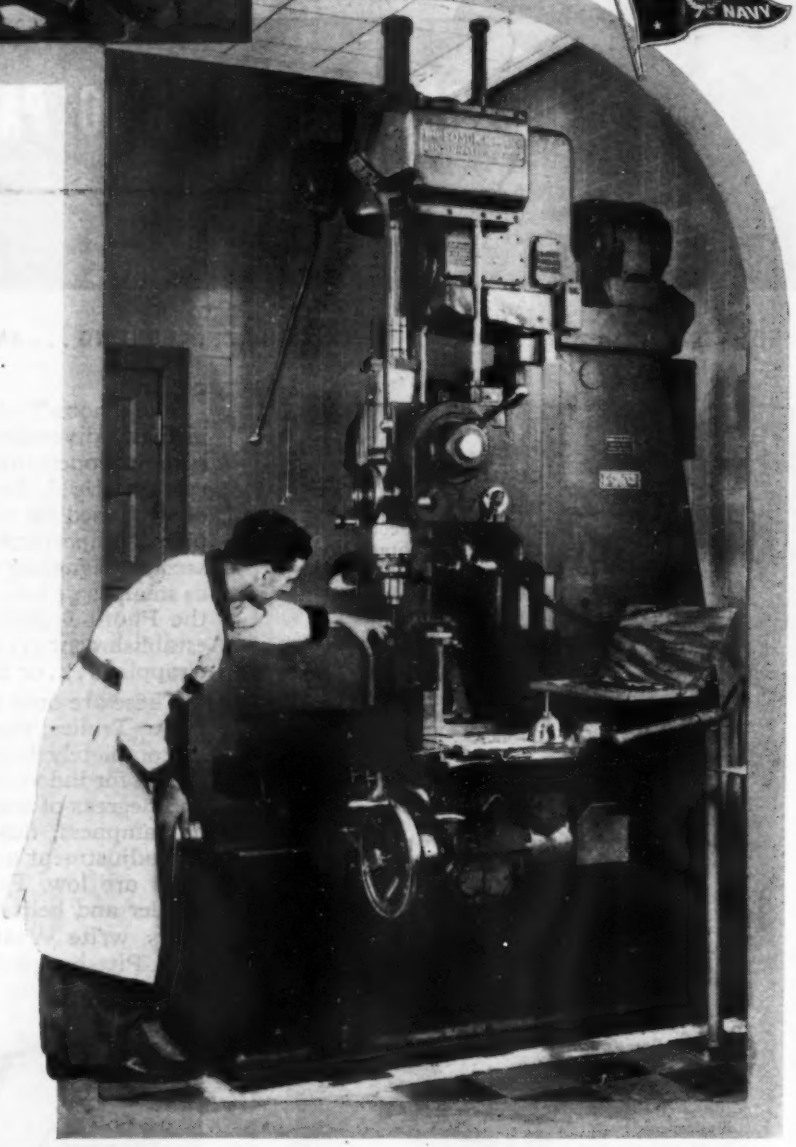
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at Work

When you need precision - - -

FOSDICK
JIG BORER



● This operator is making certain that everything is perfect before starting to bore three 1⅛" holes to tolerances of plus or minus .0002 on a Fosdick Jig Borer.

The job is a welded construction fixture for a prominent airplane company and the machine is installed at Craftsman Tool & Die Company.

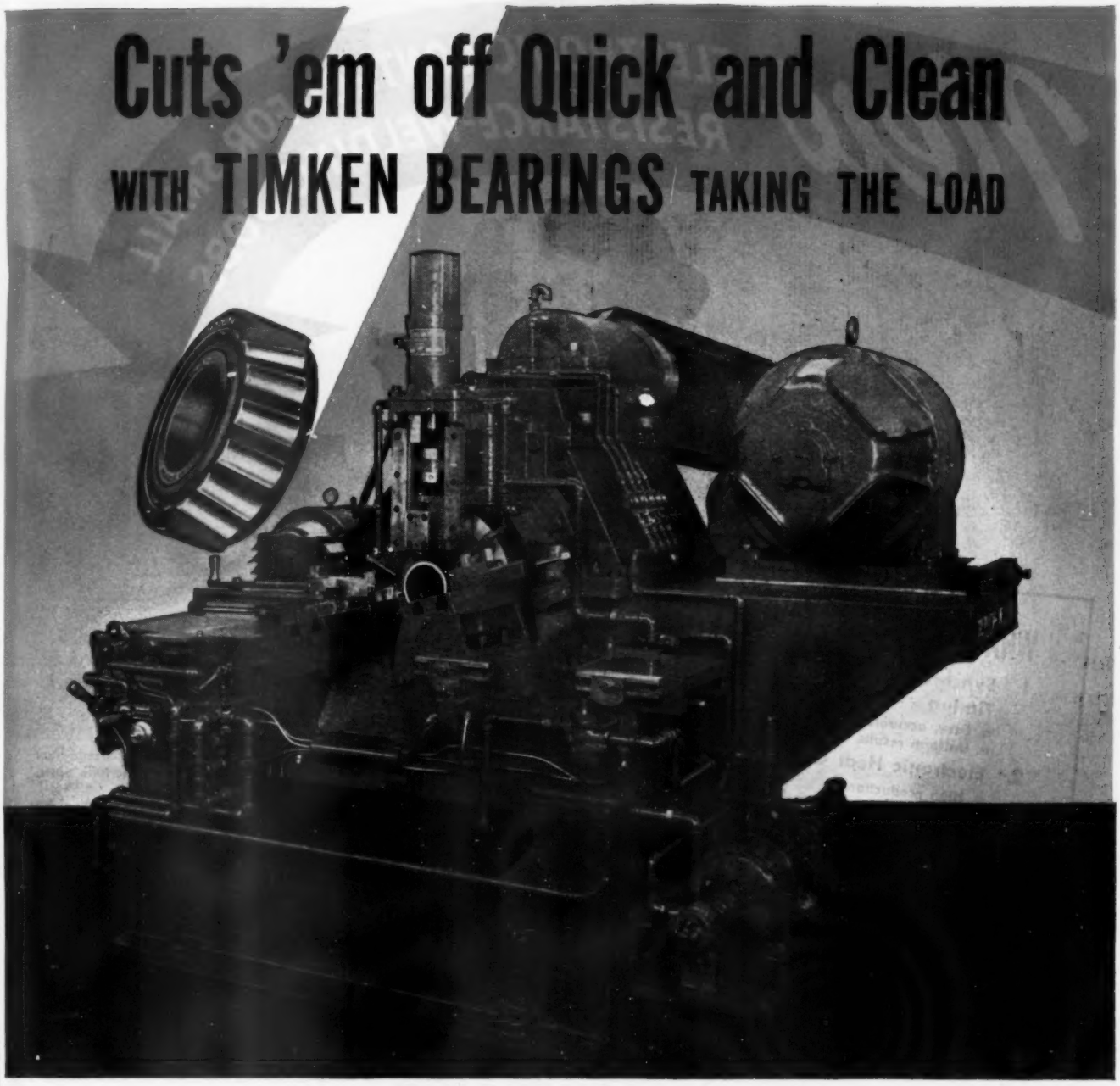
Why take chances on precision boring, drilling, reaming and similar operations—the Fosdick Jig Borer has the rigidity to hold close tolerances—simplicity of operation to meet production demands—and adaptability to cover a wide range of diversified operations.

For complete information on this moderately priced precision machine ask for the Fosdick Jig Borer bulletin J. B. A.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, · · · OHIO

Cuts 'em off Quick and Clean

WITH TIMKEN BEARINGS TAKING THE LOAD



A Taylor-Wilson Tube Cut-off Machine equipped with Timken Bearings. Capacities range from 1" to 24" OD.

Taylor-Wilson Tube Cutting-off Machines are designed and built to do their work with speed and precision and to stand up under continuous operation without loss of efficiency.

The manufacturer, Taylor-Wilson Mfg. Co., Pittsburgh, Pa., knows that the importance of bearings cannot be discounted when speed, accuracy and endurance are in the balance—and proves it by using Timken Tapered Roller Bearings.

Nothing can take the place of the Timken Bearing's smooth operation, radial-thrust load capacity, alignment preservation and endurance —backed as these qualities are by 47 years of research, experience and engineering development.

Engineers prefer Timken Bearings because of their ability to meet—and beat—every condition of bearing operation in all kinds of machines. Sales executives prefer them because their presence is one of the strongest sales incentives any machine can have.

But be sure the trade-mark "TIMKEN" appears on every bearing that goes in your equipment; this is your assurance of bearing performance at its best. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

New ELECTRONIC CONTROL FOR SMALL RESISTANCE-WELDING JOBS

This new G-E electronic heat control used with a small bench welder is an important factor in the high production rate attained in the welding of electronic tube parts.

WHAT IT OFFERS YOU

1. Synchronous Precision Timing
   a. Easy, accurate adjustment
   b. Uniform results
2. Electronic Heat Control
   a. High production
   b. Little or no distortion of material
   c. Satisfactory welding of small difficult-to-weld parts

NOW you can be certain that your low-capacity spot welders will be precisely controlled, insuring better welding results. When connected to a suitable transformer, this control, used either on a bench welder or with welding tongs, makes an ideal combination for welding of all sorts of small parts. A good example of this is in the welding of tube parts where tungsten, fernico, copper, tantalum, magnesium, and molybdenum are constantly being welded with good results.

Synchronous Precision Timing

You know that accurate control of weld time is essential to the consistent welding of small parts, because the optimum weld time for high production and little distortion is less than ten cycles. In fact, it is often only one or two cycles.

Synchronous precision timing enables you to adjust the weld time in one-cycle steps from one to ten cycles. Also, with this type of timing you are assured that the preset timing will be exact (no deviations from weld to weld).

Electronic Heat Control

You also know that, in welding small parts, it is vital to have a means of adjusting the current to very close values, as relatively slight changes in welding current will result in either no welds, weak welds, or burned parts. Adjustable electronic heat control provides the necessary preciseness of current control for welding small parts—especially those metals and alloys which are difficult to weld consistently.

Flexibility of Operation

This equipment is suitable for operation on either 230- or 460-volt, 60-cycle power supply. Because the tubes have the same current rating on either voltage, the transformer that is used on a 460-volt supply can be twice as large as that required on a 230-volt source—this will approximately double the secondary or welding current.

How This Control Can Help You

If you're doing small welding jobs, this control can undoubtedly help you speed up production by providing precise welding control, and thereby reducing rejects. Our local office will be glad to send you further information on the CR7503-A140A2 timer, or talk over the possibility of installing these controls on your assembly line. However, if you prefer, write directly to General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

RESISTANCE-WELDING CONTROL

Buy all the BONDS you can—
and keep all you buy

Here's how American Magnesium is building 40-gallon Oil Tanks for P-47N Thunderbolt fighters.

Certainly . . . MAGNESIUM SHEET HAS FORMABILITY

It took a heap of squeezing, many humps and hollows to fit this 40-gallon oil tank into a former 28-gallon tank space. Magnesium sheet has the formability to do the job.

American Magnesium's more than twenty-five years' experience in working with magnesium provides real know-how. Mazlo Magnesium sheet can be successfully formed cold, warm or hot, depending upon the design of the part involved.

American Magnesium will gladly share the know-how gained through its many years of designing, manufacturing, and assembling magnesium parts. For this assistance we invite you to write Aluminum Company of America, Sales Agent for Mazlo Magnesium Products, 1709 Gulf Building, Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

For Grinding the Carbides, Glass, Ceramics and Quartz . . .

A Complete Line of
NORTON DIAMOND WHEELS

METAL, RESINOID AND VITRIFIED BONDED

YOU can get Norton Diamond Wheels not only in all the popular sizes and types for grinding carbide tools but also in a wide range of sizes and shapes for use on materials that are unworkable with ordinary grinding wheels. The three Norton bonds—Metal, Resinoid and Vitrified—make it possible to meet many different conditions.

GLASS (Lenses, Prisms, Reflectors, Plate) Diamond Wheels for Cylindrical and surface grinding, cutting-off, edging, lens generating.

CERAMICS (Porcelain Insulators, Tile, Brick) Diamond Wheels for centerless, cylindrical and surface grinding and for cutting-off.

QUARTZ (Crystals) • Diamond Wheels for cutting, wafering, dicing, surfacing and edging.

Perhaps you have an unusual job that needs diamond wheels. A Norton abrasive engineer will be glad to give you the complete story.

NORTON COMPANY
Worcester 6, Mass.

NORTON ABRASIVES

W-1024

NEW

National Acme Hydraulic Thread and Form Rolling Machine

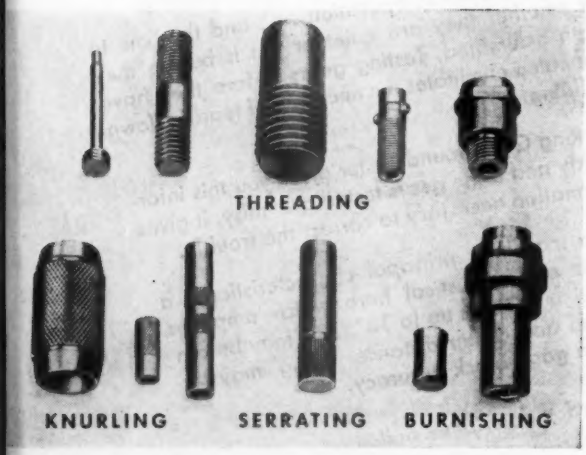
This new National Acme production tool—a Thread and Form Roller, hydraulically operated and completely automatic—is especially built for economical production of smooth, accurate threads and forming work, to the finest auto motive and aircraft precision standards.

Three threading or forming rolls, each supported by anti-friction rolls directly in line with the work, insure uniform pressure. This avoids distortion — especially important for second operation on hollow work.

Two standard heads are available and are interchangeable—one for 3/8 to 9/16" work and one for 9/16 to 1" work—1½" maximum length. Other sizes on application.

Hand fed, this machine will turn out 900 pieces per hour, and magazine fed, up to 2000 pieces. It does not require an experienced operator, and affords unusually long life for thread rolling tools.

We'll gladly give you additional data, prices and delivery dates.

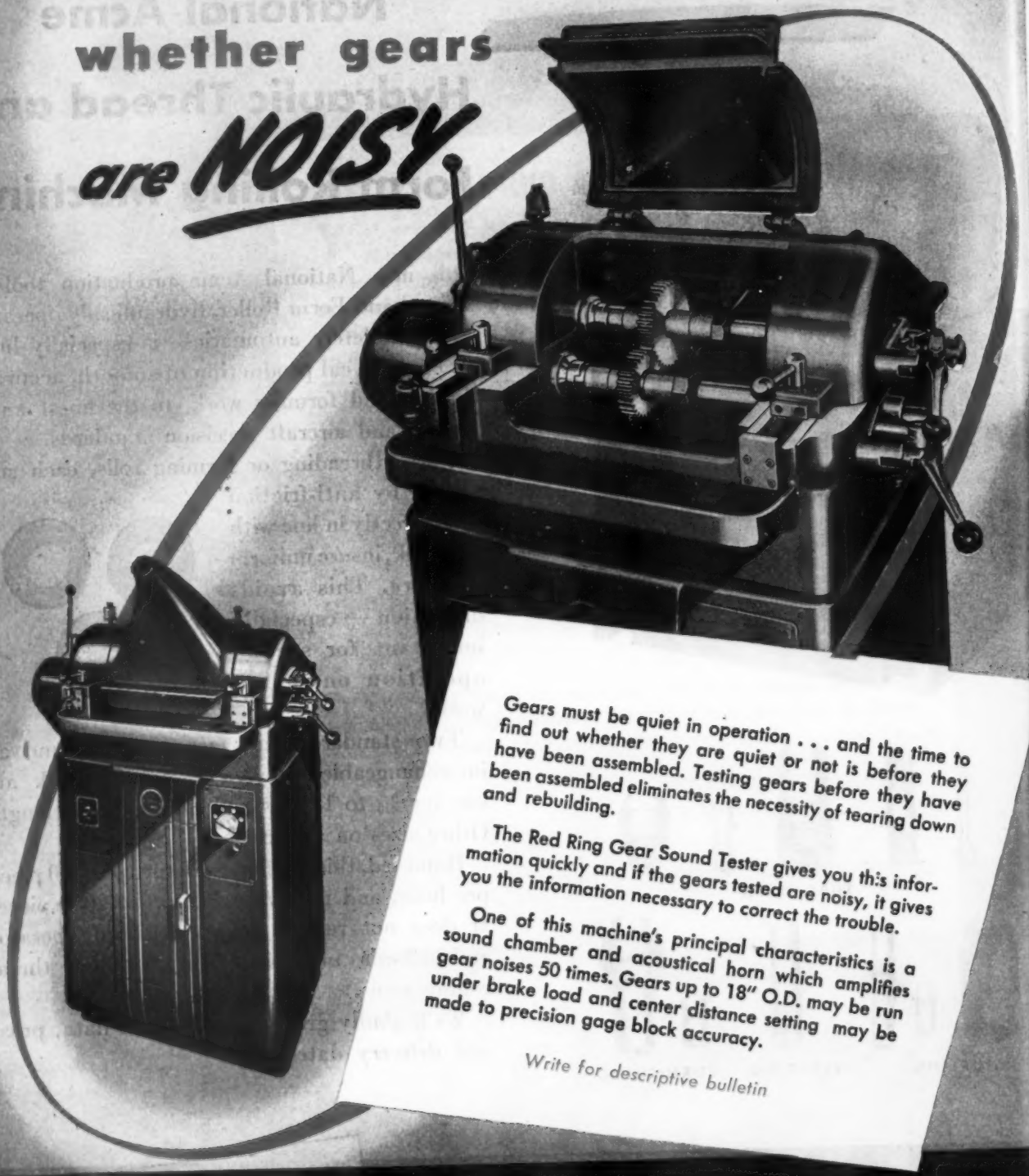


The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

FIND OUT before ASSEMBLY whether gears are NOISY.



Gears must be quiet in operation . . . and the time to find out whether they are quiet or not is before they have been assembled. Testing gears before they have been assembled eliminates the necessity of tearing down and rebuilding.

The Red Ring Gear Sound Tester gives you this information quickly and if the gears tested are noisy, it gives you the information necessary to correct the trouble.

One of this machine's principal characteristics is a sound chamber and acoustical horn which amplifies gear noises 50 times. Gears up to 18" O.D. may be run under brake load and center distance setting may be made to precision gage block accuracy.

Write for descriptive bulletin

RED RING PRODUCTS

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICH.

SPECIALISTS IN SPUR AND HELICAL INVOLUTE GEAR PRACTICE
- ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

"I didn't know you could weld aluminum!"

Strange, how often you still hear that exclamation. Gas welding, spot, butt, seam and electric arc welding, furnace, torch and dip brazing are all figuring importantly in war work. You'll find experienced operators everywhere.

These joining methods, coupled with the many economic advantages offered by Alcoa Aluminum products, will help determine the winners in the battles for postwar markets.

Alcoa has a book which discusses in detail all of these methods—"WELDING and BRAZING ALCOA ALUMINUM"—helpful for your product designers and plant men. For a free copy, write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

Girls make accurate, airtight aluminum radar housings by gas and electric welding

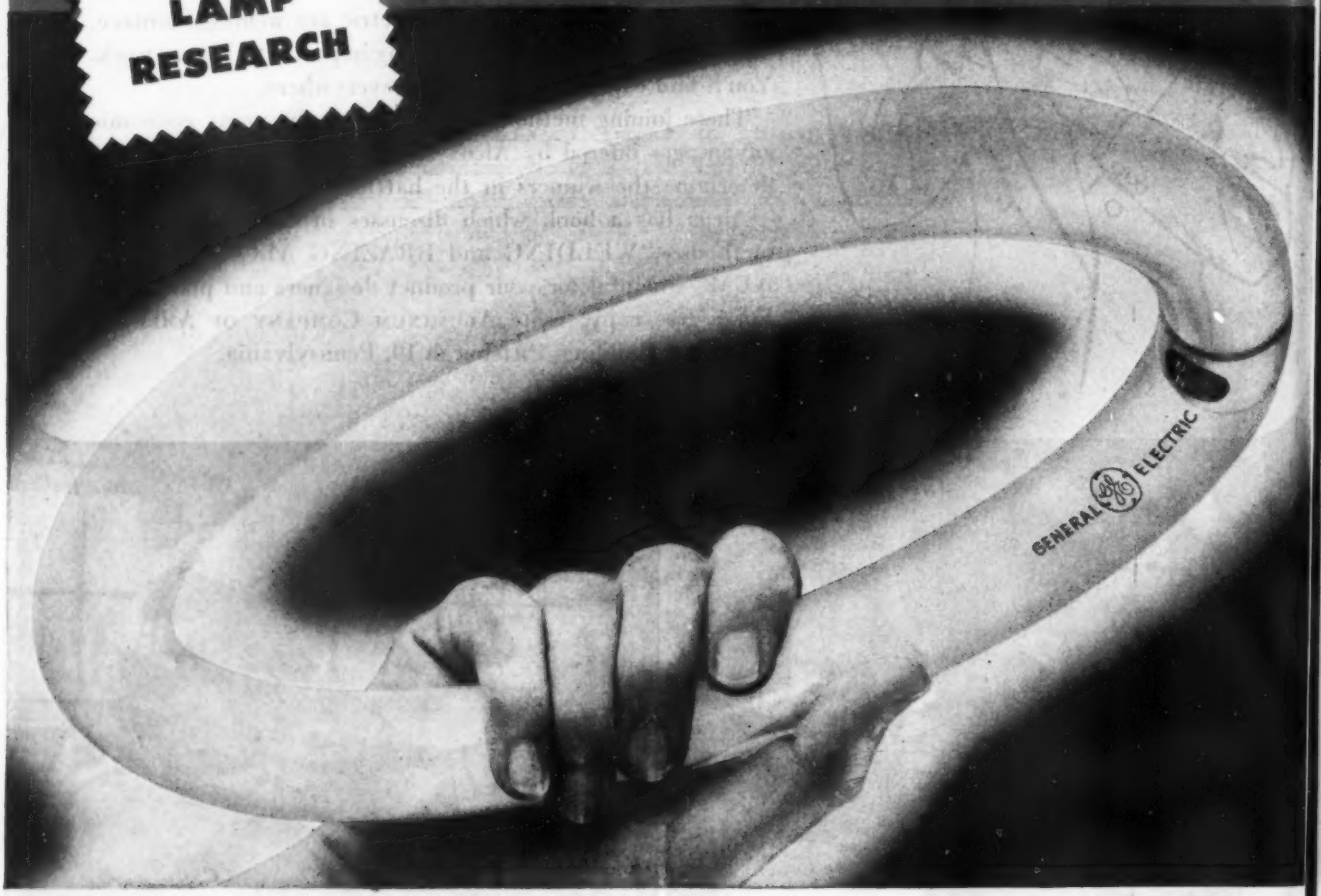
FIRST IN

ALCOA ALUMINUM

ALCOA ALUMINUM

ANOTHER **FIRST** FOR G-E LAMP RESEARCH

G-E "CIRCLINE" FLUORESCENT LAMPS



WITH development of G-E CIRCLINE Lamps, new opportunities open up for use of cool, efficient, glare-free fluorescent lighting in industry.

First G-E CIRCLINE Lamp to be completed (available early next year) has an outside diameter of 12 inches and a tube diameter of 1¼ inches. Two additional lamps are planned, with outside diameters of 8½ and 16 inches. The 12-inch lamp will operate at 32 watts and 84-86 volts. Its light output is estimated at 1600 lumens and brightness at 2040 footlamberts. Tests indicate a rated life corresponding to the standard 40-watt fluorescent lamp.

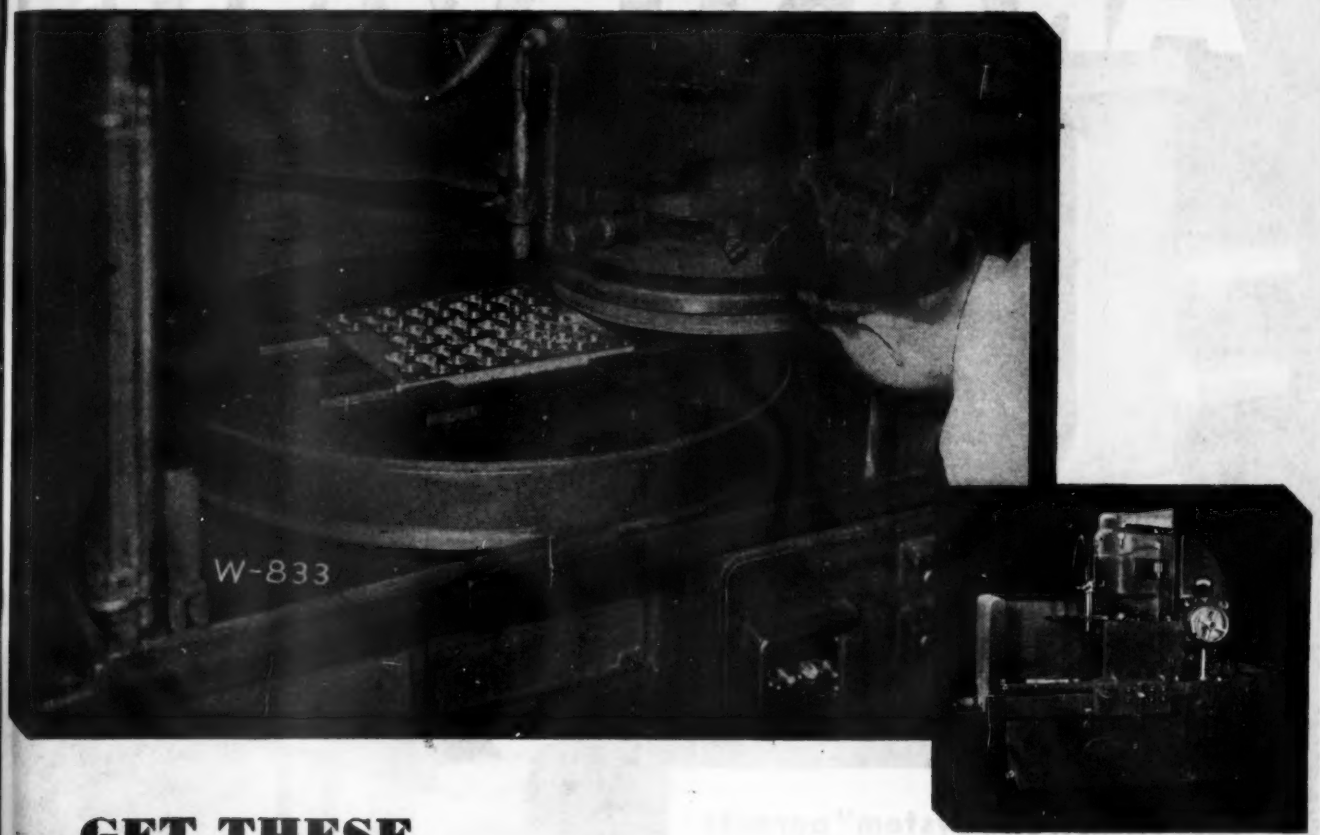
LAMPS
GENERAL ELECTRIC

TYPICAL INDUSTRIAL APPLICATIONS SUGGESTED FOR G-E CIRCLINE LAMPS

CIRCLINE Lamp furnishes diffused, even illumination on working surface in this idea for machine tool lighting.

Many difficult inspection jobs will be easier with the use of G-E CIRCLINE Lamp to "surround" with light the object inspected.

"Put it on the Blanchard"



No. 18 BLANCHARD SURFACE GRINDER

...GET THESE ADVANTAGES

Production ✓
Adaptability ✓
Fixture Saving ✓
Operation Saving
Material Saving
Fine Finish
Flatness ✓
Close Limits

Non-Magnetic Work is Easily Ground

These brass plates 14½" x 12⅝" x ¾" are ground on both sides to almost clean the surfaces before holes are drilled. After drilling, one side is ground flat within .003" removing .005" to .006" of stock. Production is 15 plates per hour.

The brass plate is laid on the magnetic chuck and blocked on all sides by steel pieces held magnetically. The picture shows the plate as chucked for finish grinding. In rough grinding the same setup is used with shims under the work, if needed, to prevent rocking.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

ARMSTRONG

The "Armstrong System" permits *the new higher cutting speeds*

The urgencies of war have lead to the universal use of greatly increased cutting speeds. Today it is not uncommon to find production machine tools actually operating *many times faster* and with greater efficiency than the "standard" cutting speeds of past generations permitted. What is also generally understood is that a similar step-up is equally practical for ordinary operations on standard tool room lathes, planers and shapers.

With the correct ARMSTRONG TOOL HOLDERS for each operation and modern ARMSTRONG HIGH SPEED, ARMIDE (Carbide-Tipped) and ARMALLOY (Cast-Alloy) Cutters, Bits and Blades, you can safely increase both speeds and feeds materially, reducing machining time per operation or piece and substantially raise your output per machine-hour.

With the Armstrong System you can make this change-over to high speed operation at will, for ARMSTRONG TOOL HOLDERS and ARMSTRONG CUTTERS are stocked by the leading industrial tool departments in your locality and can be purchased as needed. Start the "modernizing" program now, write for catalog.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. Francisco Ave. Chicago 12, U.S.A.
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199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. & Sales Office:
1275 Mission St., San Francisco 3, Calif.

Buy ARMSTRONG Tools from your Dealer

ARMSTRONG TOOL HOLDERS Are Used In Over 96% of the Machine Shops and Tool Rooms

BURNING QUESTIONS *Answered!*

WHY A POSITIVE CLUTCH?

Because it revolutionized apron operation of lathes and made friction feeds obsolete. It marked the beginning of a new ease in lathe operation—new precision—new power. Eliminates possibility of sticking frictions and spoiled work. Just one lever controls this smooth, constant powerful feed—both longitudinal and cross—**just one lever.** A safety clutch provides the lathe with full protection. The positive clutch is another original and exclusive LeBlond feature . . . another important reason why LeBlond Lathes are turning the world over.

★

SINCE 1887

the world has been turning to LeBlond for turning equipment.

★

THE TIME TO PREPARE IS NOW!

LeBlond field engineers are at your service to help you in your development work, particularly along the lines of the difficult, the "out-of-the-ordinary" turning problems. The accumulated knowledge of every manufacturing trend in good times and bad—peace and war—gained over a period of nearly 60 years from thousands of installations all over the world, is yours for the asking. Contact our nearest dealer or write Department FE46.

WRITE FOR CATALOG!

THE R. K. **LeBLOND**

★ YOUR BONDS BUY BOMBS ★
BUY A "BLOCK-BUSTER" TODAY!

MACHINE TOOL CO., CINCINNATI 8, OHIO, U. S. A.

NEW YORK 6, Singer Bldg., 149 Broadway, WOrth 2-0722
CHICAGO 6, 20 North Wacker Drive, STA 5561

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

QUALITY and DEPENDABILITY

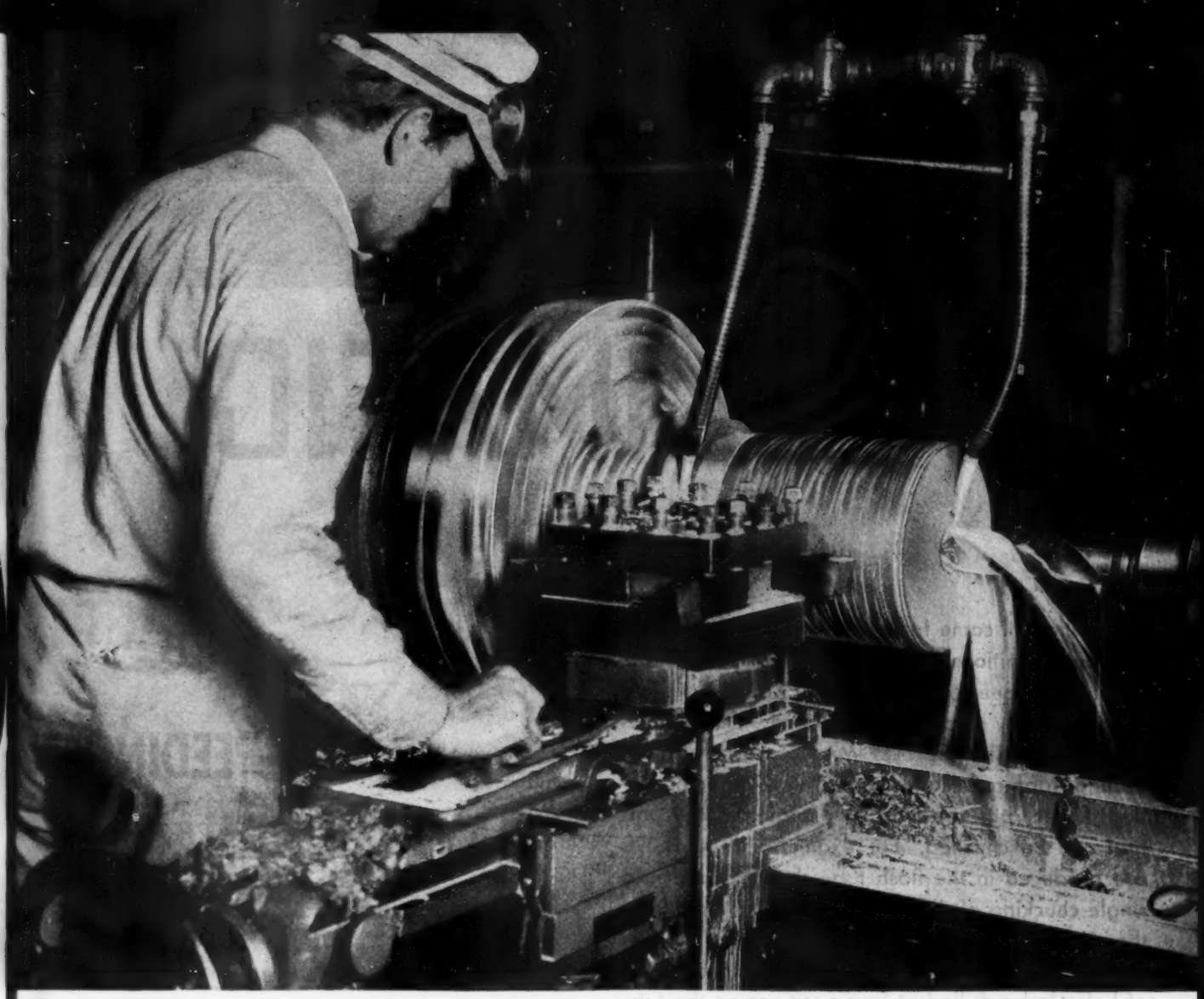
● Engineered quality and dependability of performance are the hallmarks of products of the Mid-West Abrasive Company.

Mid-West's outstandingly successful tool room grinding wheel, and every other product of the broad Mid-West line—honing stones, sharpening stones, coated abrasives, disks and wheel dressers—all must bear these two hallmarks.

Let quality and dependability guide you in your choice of abrasives, and we feel certain that choice will be Mid-West. Prompt delivery on all items.

MID-WEST ABRASIVE CO.

Manufacturers of DEPENDABLE Abrasives · Owosso, Mich. · Detroit · Rochester, Pa.

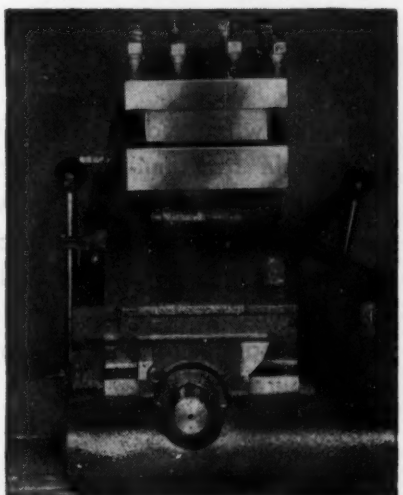


WHY THE GISHOLT SQUARE TURRET IS *Better*

Yes, the quick and effortless positioning of tools with the Gisholt square turret makes it an important factor in increasing production and reducing costs.

It starts with reversible power rapid traverse for longitudinal travel. But Gisholt *also* provides it for the transverse movements of the cross slide. This is a *standard feature* on all Gisholt Saddle Type Turret Lathes. The Gisholt cross slide traverse can be operated independently —or simultaneously with carriage longitudinal traverse to save time and effort.

With quick indexing, firm clamping, and rigid mounting to assure permanent accuracy, the Gisholt square turret is an important asset to faster production and lower cost.



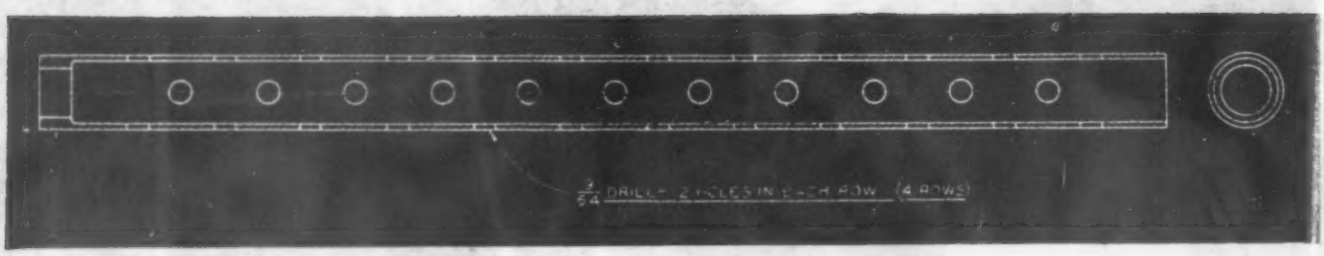
GISHOLT'S SQUARE TURRET *is made from a steel forging. Note the powerful circumference-type clamp, the hardened and ground steel plates and gibs for the cross slide, and the fully enclosed cross feed screw.*

GISHOLT MACHINE COMPANY
E. Washington Ave. • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . with Gisholt Improvements in Metal Turning

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES



FLEXIMATIC

by KINGSBURY

When the call came for machines capable of turning out munitions and aircraft parts at mass-production speeds, Kingsbury FLEXIMATICS were ready! Quickly made up of standard units mounted on standard bases. FLEXIMATICS can perform drilling, tapping, reaming and many other operations in any position or at any angle on any part that can be chucked. For example, all 48 holes are produced in the flash tube shown above in a single chucking of the work. Each work holder on the main turret is in itself a turret which indexes as the main turret indexes, thus enabling the rows of holes to be drilled at four positions on the tube without removing the work. Various lengths of tube can be handled by the machine by adjusting the position of the top clamping member.

JOB

...SPEEDING NAVAL ORDNANCE PRODUCTION!

Speeding war production by making it possible for semi-skilled labor to turn out large volumes of precision parts, Kingsbury FLEXIMATICS possess the added advantage of FLEXIBILITY that permits quick, easy changeovers to meet changes in design or machining requirements.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

More than a dozen points of attachment are provided by this Alcoa Aluminum forging. Its use avoids high labor costs and manufacturing hazards, entailed in building up a part for the same task. A maximum saving in weight is achieved.

All of the usual advantages gained with Alcoa Aluminum are retained—strength, lightness, corrosion resistance and dependability.

Intricate parts, surprisingly large in size, are possible in Alcoa Aluminum forgings. Alcoa engineers, skilled in their design and production, will gladly assist in adapting aluminum forgings to your products. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM

You Name the Job—

Thor will

GETTING THE JOB DONE RIGHT and fast is assured with this Thor Air Drill doing duty in an aircraft plant where precision is a "must."

TAKING AWKWARD LOCATIONS in stride is the job of this small capacity pneumatic nut setter with angle attachment. Called upon to drive hundreds of nuts to exact tension in this assembly, it does its job swiftly and efficiently.

name the air tools

...TO DO IT FASTER, EASIER, CHEAPER!

In virtually every major industry you will find Thor Portable Pneumatic Tools first choice of production engineers and maintenance men. In mass installations in automotive and aircraft factories—in unit job applications in steel mills and foundries—in machine shops—in railroad shops—in countless types of plants, Thor Pneumatic Tools are giving dependable performance.

The unequalled range of tools made by Thor—over 900 models of 52 basic types—plus more than 50 years of experience in building quality tools are the reasons for this widespread acceptance. Whatever your requirements are for portable power tools Thor can meet specific needs exactly—and surely.

See that the trademark "Thor" is on every portable power tool you use.

INDEPENDENT PNEUMATIC TOOL COMPANY
600 W. Jackson Boulevard, Chicago 6, Illinois
New York Los Angeles

FINE FINISHES are the rule in this metal-working plant because of the ease of control and uniform speed of this rotary type Thor Pneumatic Sander.

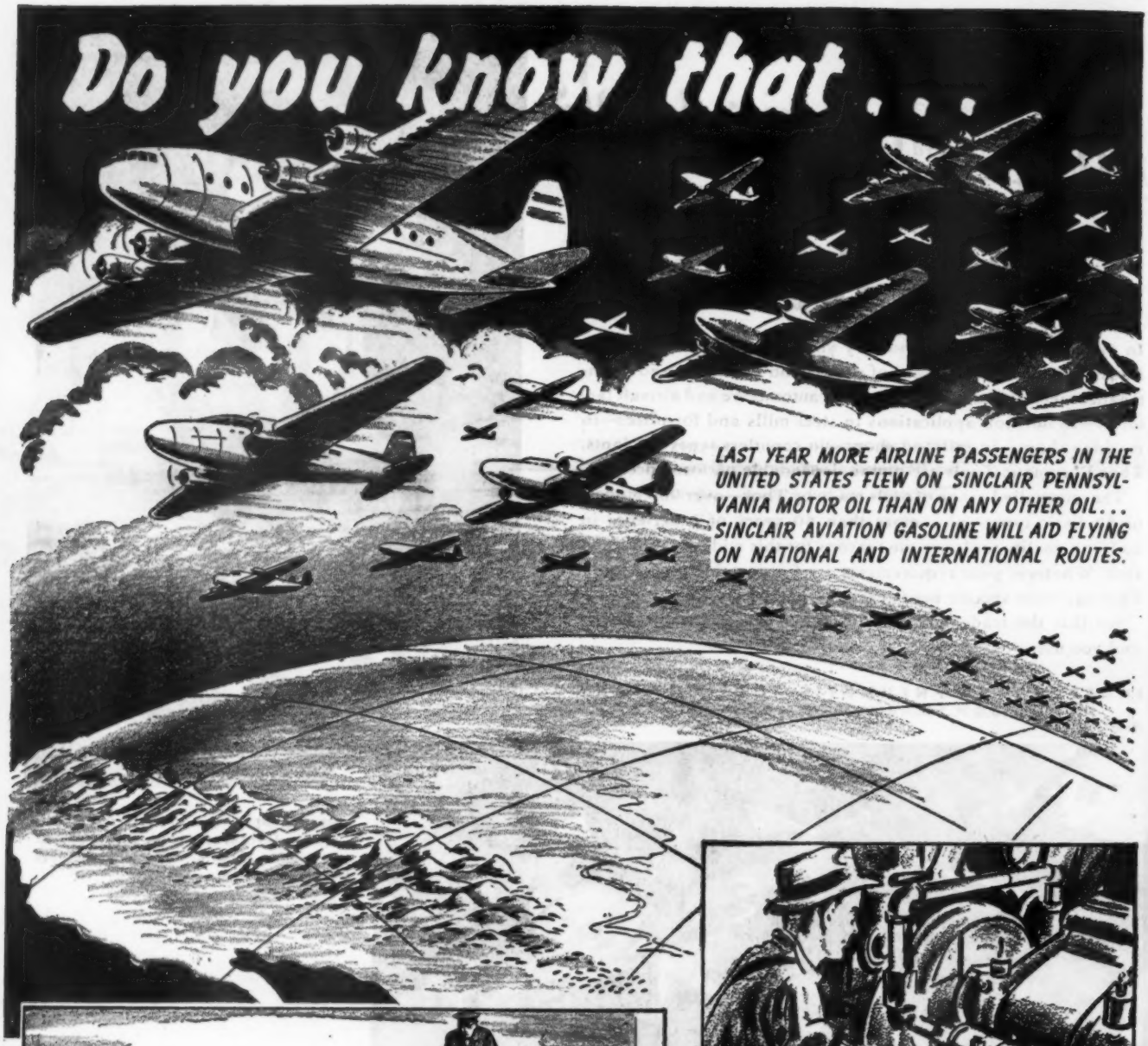
"A BEAR FOR PUNISHMENT" is this heavy-duty Thor Air Grinder at work on a large casting. It takes off metal fast and is easy to handle. (background)

POSITIVE CONTROL of power and speed is the major reason why Thor Chipping Hammers are preferred by foundries everywhere. (foreground)

Thor PORTABLE POWER **TOOLS**

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS

Do you know that . . .



LAST YEAR MORE AIRLINE PASSENGERS IN THE UNITED STATES FLEW ON SINCLAIR PENNSYLVANIA MOTOR OIL THAN ON ANY OTHER OIL . . . SINCLAIR AVIATION GASOLINE WILL AID FLYING ON NATIONAL AND INTERNATIONAL ROUTES.

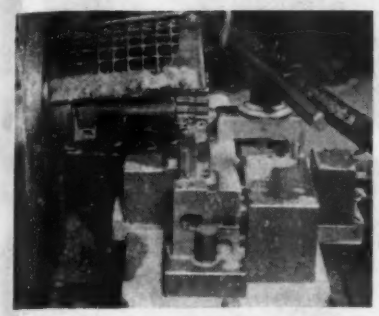
SINCLAIR TANK TRUCKS OPERATE OUT OF 2000 WHOLESALE BULK PLANTS WHICH SERVICE INDUSTRIAL PLANTS, AS WELL AS MANY THOUSANDS OF SINCLAIR DEALER STATIONS, WITH PETROLEUM PRODUCTS.

FOR BETTER LUBRICATION OF MACHINING EQUIPMENT, SINCLAIR PRODUCES A WIDE RANGE OF SPECIALIZED HYDRAULIC, SPINDLE, GEAR AND GENERAL PURPOSE OILS . . . ALSO A DIVERSIFIED LINE OF CUTTING OILS ADAPTED TO EVERY MACHINING PROBLEM.

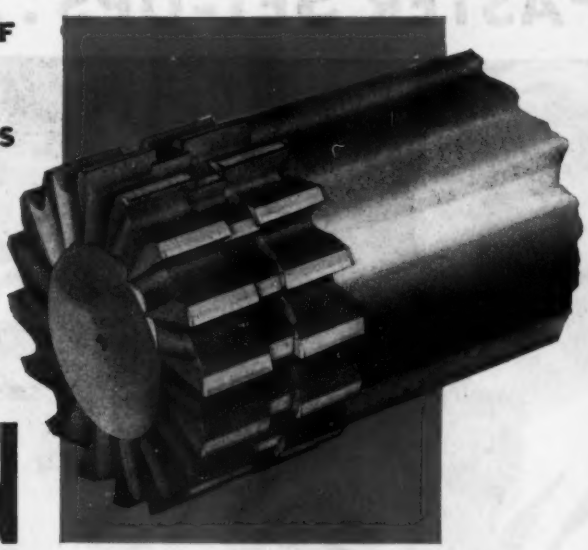
SINCLAIR IS EQUIPPED TO SERVE YOU BETTER!

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

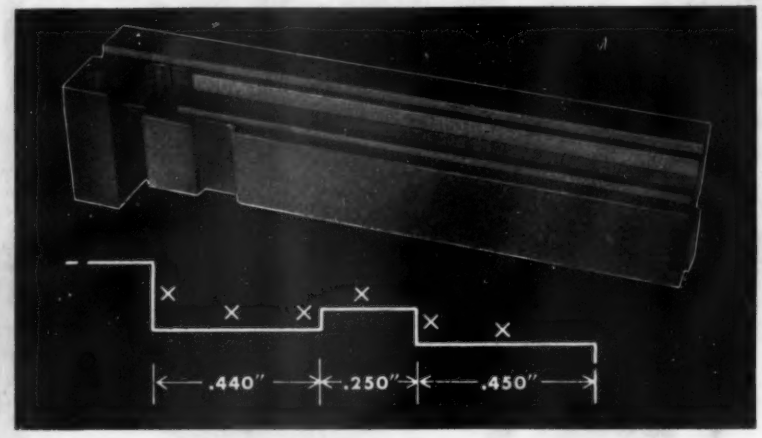
COMBINATION OF SPECIAL PLAIN AND SIDE MILLS



A close-up of the fixture used to hold gun bolts for the milling operation described below.



BARBER-COLMAN *ENGINEERED* MILLING CUTTERS



ACCURATELY MILLING WAYS ON BOTH SIDES OF GUN BOLTS AT 19 PCS. PER HOUR WITH VERY FINE FINISH

In the course of machining the gun bolt shown above, one of the steps is to form the ways on the sides to close tolerances. Ordinarily, this might be done by a slabbing operation followed by two end milling operations in order to obtain proper finish and accuracy on the six surfaces involved. A combination of properly designed cutters does this job in *one* operation. The gang consists of two side mills and one plain mill shown at the top of the page. This gang mills all six surfaces in one pass at a good production rate, good cutter life, holding the required accuracy, and obtaining a fine finish. The piece is clamped in a fixture and one side milled, then the piece is turned over and the other side, having identical form and dimensions, is milled. Production is 19 completed pieces (both sides) per hour. The cutters ate 1⅞" x .440", 1.716" x .250", and 1⅞" x .450", with diameters held relative within .001". The two larger cutters have side cutting teeth to give fine finish on the vertical surfaces, and their inside teeth overhang the teeth of the plain mill. When assembling the cutters, the teeth are lined up properly to prevent chips loading up in the pockets and scoring the work. The feed is 5⅛" per min. for a 7½" cut; surface feet per minute is 89.5; and chip load per tooth, .0016". Stock removed is approximately .015". Cutters give 300 pieces per grind, and are sharpened once each shift of 9.6 hours. *Barber-Colman Engineers develop profitable, time-saving answers for many milling problems — let them do the same for yours!*

BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

FASTER SET-UPS . . EASIER OPERATION

No 2 CENTERS* TAKE 30" LENGTH

No 3 CENTERS* TAKE 40" LENGTH

No 4 CENTERS* TAKE 60" LENGTH

Complete equipment furnished with each machine adapts it to a wide variety of work

*Machines swing 14" diameter over table — 12¾" diameter over water guards

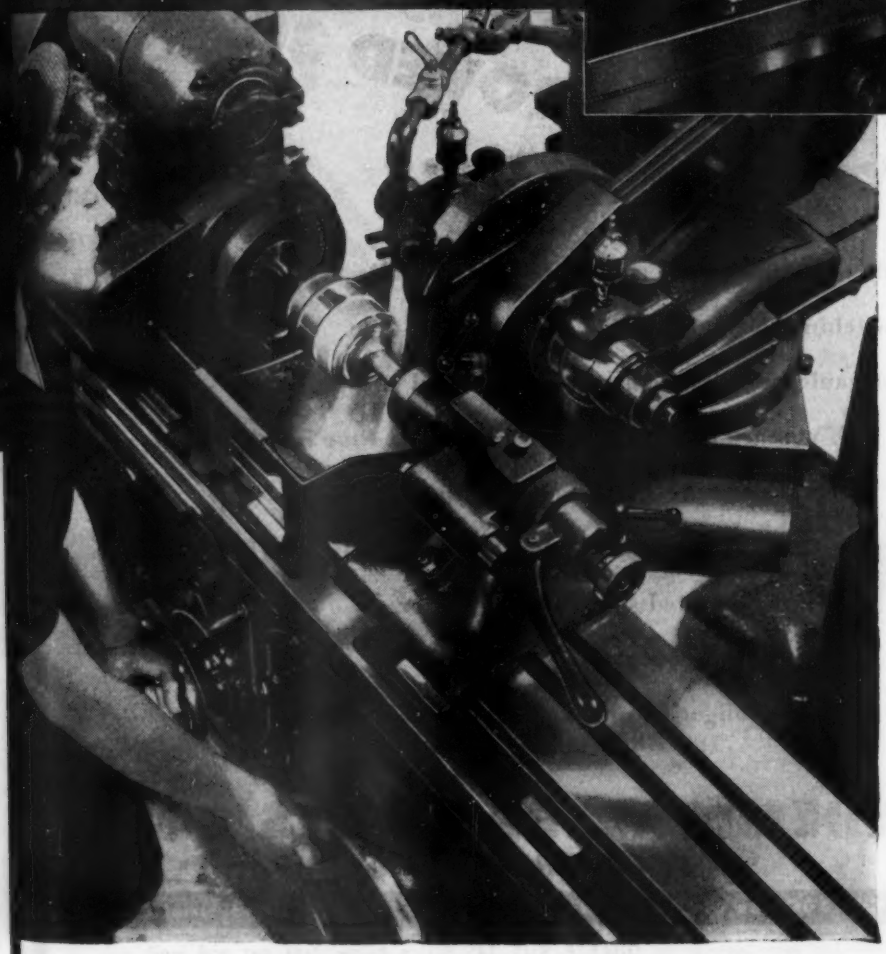
BROWN &

ON THESE *ACCURATE* UNIVERSALS

Dependable grinding on all types of Toolroom and Production jobs–

CYLINDRICAL
INTERNAL
SHOULDER
TAPER
ANGLE
FACE
– and Combination Angle and Taper

– Highly profitable through
Simplicity of design
Efficient performance
Minimum maintenance



Equipment for Right-Hand Wheel Mounting shown above . . . furnished as an extra

Check your savings in time and effort through the use of these versatile Universal Grinding Machines on your precision work.

B·S BROWN & SHARPE MFG. CO.
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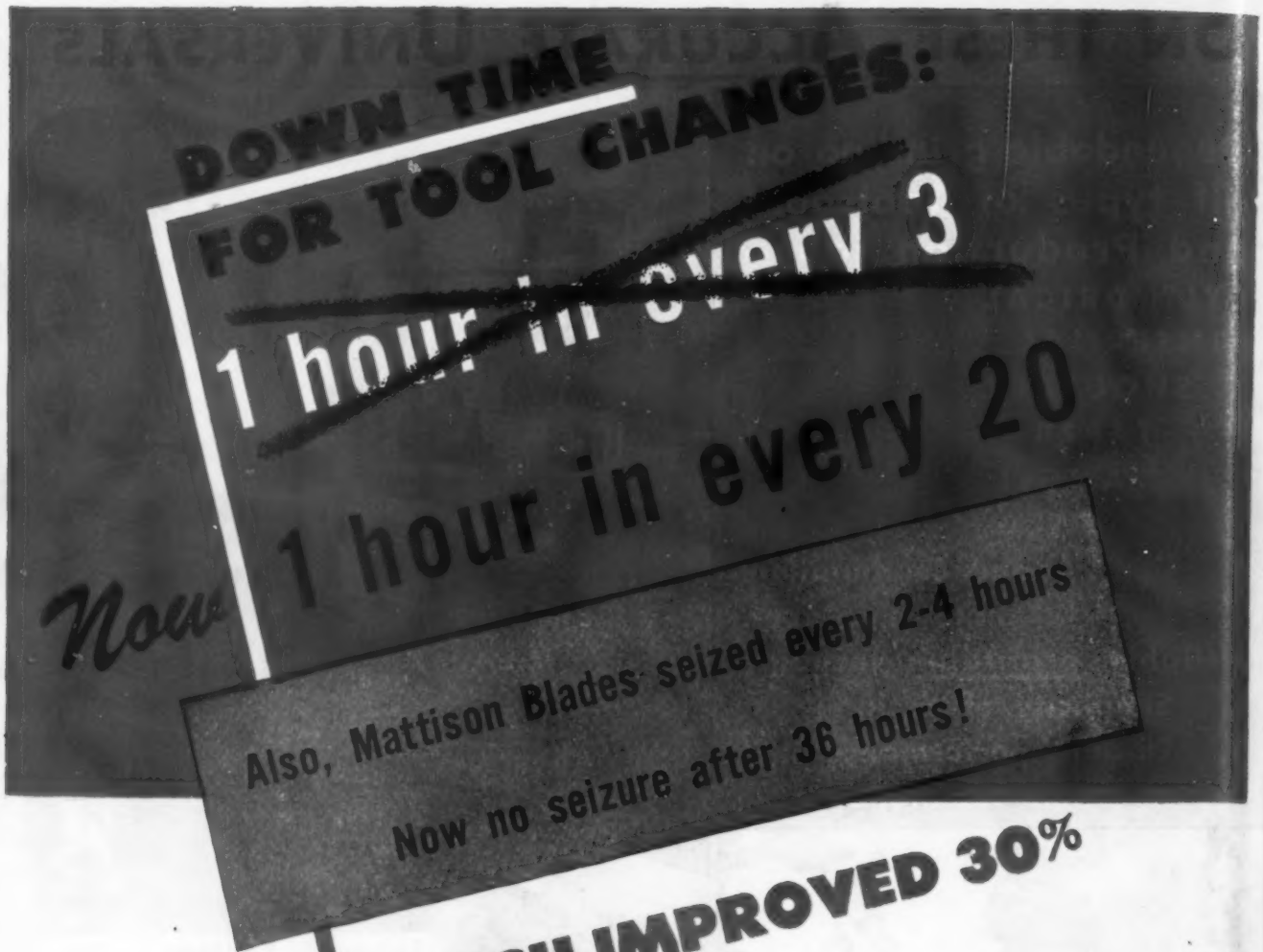
SHARPE


DOWN TIME
FOR TOOL CHANGES:
1 hour in every 3
Now 1 hour in every 20
Also, Mattison Blades seized every 2-4 hours
Now no seizure after 36 hours!

FINISH IMPROVED 30%

This was done on a 6 spindle Cone Automatic... after switching to QUAKER KUT #45—a new type organic base that replaces conventional cutting oils.

If you are interested in slashing down-time in your plant, a Quaker Process Engineer will be pleased to call and determine whether QUAKER KUT #45 can be adopted successfully in your machining operations. There will be no obligation or cost to you.

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

Other Plants in CHICAGO and DETROIT Warehouse Stocks in Principal Industrial Centers

A Progressive Organization of Research and Process Engineers and Manufacturing Chemists

For more details on QUAKER KUT #45 fill in below, tear out and mail.

Name_____ Position_____

•••PLEASE PRINT COMPANY NAME AND ADDRESS IN MARGIN BELOW•••

POST-WAR PRODUCTION
will demand Precision Machining

Manufacturing costs must be kept within reason if you are to meet the keen competition that is sure to come with the post-war period. Then, if ever, you will need shop machinery that will operate with unquestionable precision. There will be no margin for loss of time, labor, and material resulting from the use of inaccurate, obsolete machines.

South Bend Lathes are designed and built to provide the extreme accuracy required for efficient production. Throughout the war they have been performing hundreds of essential war production operations with toolroom precision. Their war-time record stands as a recommendation worthy of careful consideration when peace-time plans are made. Substantial savings in capital investment, power consumption, floor space, and labor costs often result from their selection.

Today South Bend Lathes are better in every way. All of our facilities are still devoted to their manufacture. Improvements have been accelerated to meet war production needs. Their smooth, vibration-free operation at high speed permits finish turning and boring with such precision that subsequent grinding, honing, or lapping operations can often be eliminated.

Numerous attachments are available which simplify tooling South Bend Lathes for many special and unusual classes of precision work.

NEW CATALOG NOW READY
Write For It!

Illustrated in full color—showing all types and sizes of South Bend Lathes. Engine Lathes and Toolroom Lathes with 9″, 10″, 13″, 14½″, and 16″ swing. Precision Turret Lathes with ½″ and 1″ collet capacity. Ask for Catalog No. 100-D.

SOUTH BEND LATHE WORKS
LATHE BUILDERS FOR 38 YEARS
419 E. MADISON STREET SOUTH BEND 22, INDIANA

UNION

"The Tools you Buy Again"

ARE THE TOOLS THAT ASSURE BETTER, FASTER WORK AT LOWER COST

Longer lasting accuracy and greater all-round efficiency of UNION tools under stepped-up production demands are the direct result of careful selection of materials, close production control through every step in manufacture and developments in tool design which only long, specialized experience can create.

Better, faster work at lower cost should be the determining factor in selecting those small tools which play such a big part in today's production. Because such results are consistently attained with UNION TOOLS, the wisdom of specifying "UNION" is apparent.

UNION TWIST DRILL CO., Athol, MASS.

STORES—New York: 61 Reade St., Chicago: 11 So. Clinton St., Detroit: 5527 Woodward Ave., San Francisco: 121 Second St., Los Angeles: 524 E. Fourth St., Seattle: 568 First Ave., South.

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The UNION LINE

TWIST DRILLS
MILLING CUTTERS
REAMERS
HOBS
SLITTING SAWS
END MILLS
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SCREW PLATES
PROFILE CUTTERS

UNION

HARDINGE STANDARD CIRCULAR CUT-OFF TOOLS

for Brown & Sharpe machines

HARDINGE Precision Ground Circular Cut-Off Tools are available for No. 00, No. 0 and No. 2 Brown & Sharpe Automatic Screw Machines.

These Cut-Off Tools have blade thicknesses in relation to the stock diameters which can be cut off on the above machines. With our literature, you can design your form tools with a breakdown section to match the standard Cut-Off blade width.

The distance from the holder side of the Cut-Off Tool to the Cut-Off blade is held to a close tolerance; therefore, these Cut-Off Tools can be changed without readjusting other tools in the set-up.

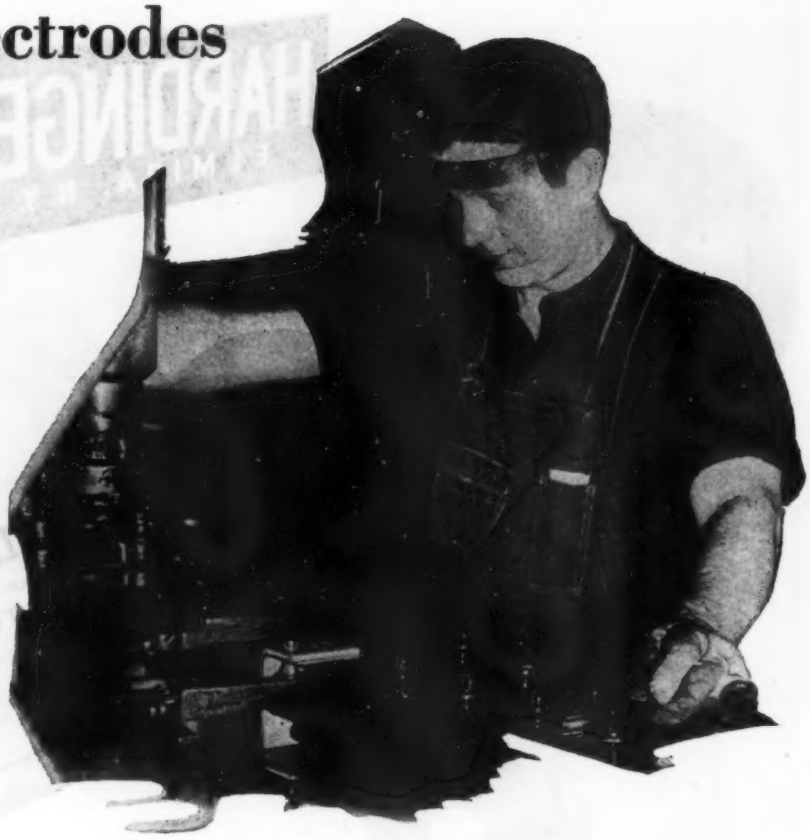
HARDINGE Circular Cut-Off Tools reduce tool inventories and set-up time—increase production.

Write for literature giving complete dimensions and prices.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

MALLORY Electrodes Speed Heavy Metal Assemblies with Pulsation Welding



SPEEDIER assembly of heavy metal parts has become possible with pulsation welding—a technique of passing repeated pulses of current through the work to be welded, without changing the position of the electrodes. The pressure applied during the welding cycle may be maintained constant but in many cases it is increased substantially from its initial value in order to effect a forging action.

Effective pulsation spot welding permits the heavy materials being welded to reach a welding temperature while minimizing the heat effects in the water-cooled electrodes. This method of resistance welding thereby reduces electrode deterioration, decreases indentation and improves the surface appearance of the weld.

In the operation illustrated, ten welds are made successively in joining a copper-plated steel bracket ¼" thick to a terminal plate of ⅛" cold rolled steel. Each weld requires six pulsations—four cycles "on"; and two cycles "off".

Standard Mallory Spot Welding Tips made of Mallory 3 Metal, mounted in *standard* offset water-cooled tip holders designed and manufactured by Mallory, are used on this special job. It's typical of the versatility of Mallory Standard Resistance Welding Electrodes—tips and holders for spot welding, seam welding wheels, and dies for flash, butt or projection welding.

Write for your copy of the Mallory Resistance Welding electrode catalog today. Also for a copy of the Mallory Resistance Welding Data Book, sent gratis to resistance welding engineers, when requested on company letterhead. Available to students, libraries and schools at $2.50 per copy, postage paid.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

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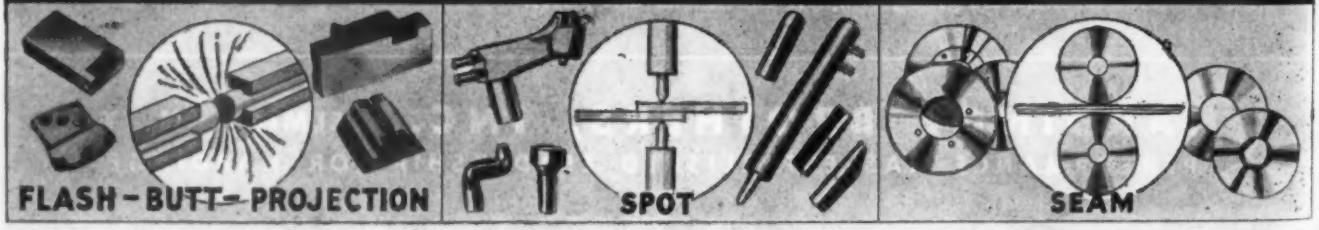
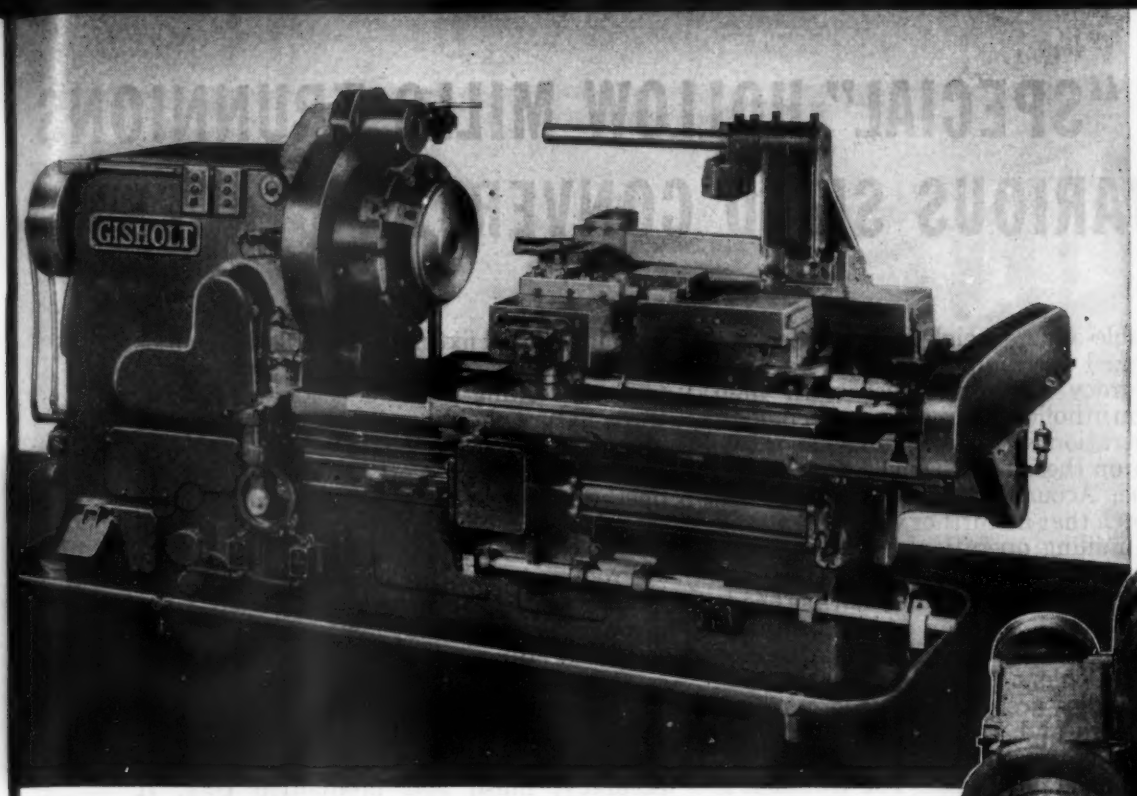
MALLORY *Standard Resistance Welding Electrodes*





YOU CAN "STRETCH" THE SIMPLIMATIC, TOO!

Yes, one of the most interesting facts about the Simplimatic is its remarkable adaptability. With the simple basic design which provides freedom from the usual restrictions, it permits the use of a greater number of tool slides, each favorably placed, each favorably cammed for its own particular cut. Thus, the machine may be individualized to solve a variety of problems. And, in each case, you enjoy the high speed production and lower costs of an automatic machine designed specifically for the job.

A typical example of this is shown at right. Here, on an extended bed, one simple cammed tool slide moves six tools through a blended turning cut on a long cylindrical piece. Two other slides face the ends. Cammed rollers behind the six tool holders move the tools transversely. A sliding pneumatic tailstock facilitates mounting the piece.

The simple adaptability of this rugged, high speed automatic lathe may solve your problems as it has hundreds of others. Ask for all the facts about the Gisholt Simplimatic.

GISHOLT MACHINE COMPANY
1201 E. Washington Ave., Madison 3, Wis.

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

Snyder "SPECIAL" HOLLOW MILLS TRUNNIONS *on* VARIOUS SIZED CONVERTER BLADES

This double-end, special-purpose machine was designed and built by Snyder to combine accuracy and fine finish with high production in hollow milling converter blades.

The operation is hollow milling one or two trunnions on these blades which vary in size and shape. Accuracy is held to .001" and finish is such that no further work is required after the milling operation.

The machine consists of two Snyder self-contained hydraulic units and multiple heads and an electrically driven fixture trunnion with holding jaws, assembled on a welded steel base. Coolant tank is in rear of base.

Tool spindles are guided in the trunnion side members and are equipped with precision end stop adjustment to maintain depth and accuracy of cut. The trunnion is indexed by a Geneva index mechanism mounted on top of the trunnion assembly.

Parts are located in the jaws by means of side locating plates. A hydraulic cylinder for each individual fixture automatically clamps the part while fixture indexes from loading to first working position. Each station has three fixtures holding three parts which are identically processed at the same time.

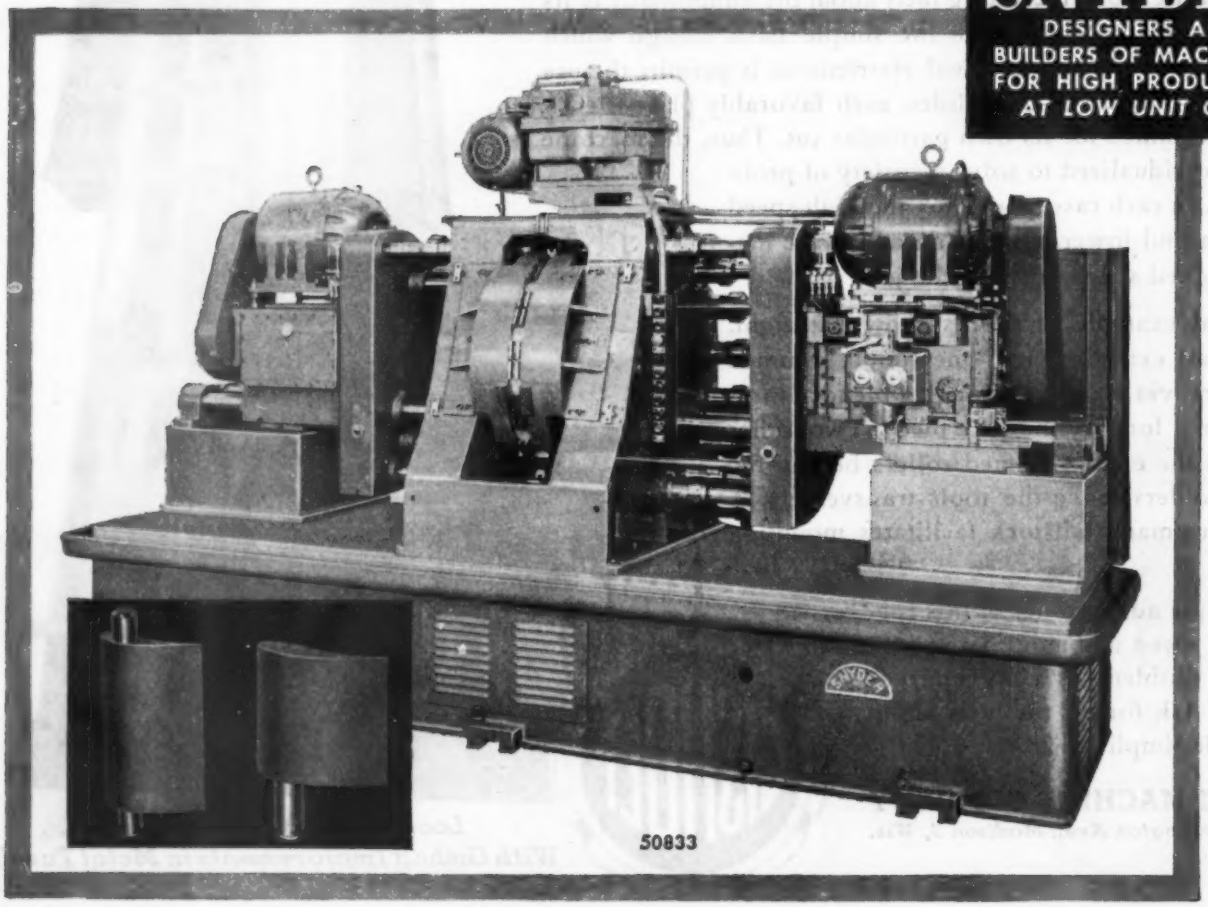
Semi-automatic work-cycle requires the operator to press a button after loading three pieces. Cycle consists of an index followed by tool work. Unloading is automatic.

Production is 575 pieces an hour at 80% efficiency. Various sized and shaped parts are accommodated by exchanging holding jaws and adjusting the side locating plates.

This is another typical example of the ability of the Snyder organization to create special-purpose machines which provide complete control over production time, accuracy, finish and production cost. If you have a production problem in the metal-cutting field, we invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette Avenue, Detroit 7, Michigan.*

20 Years of Successful Cooperation with Leading Industries

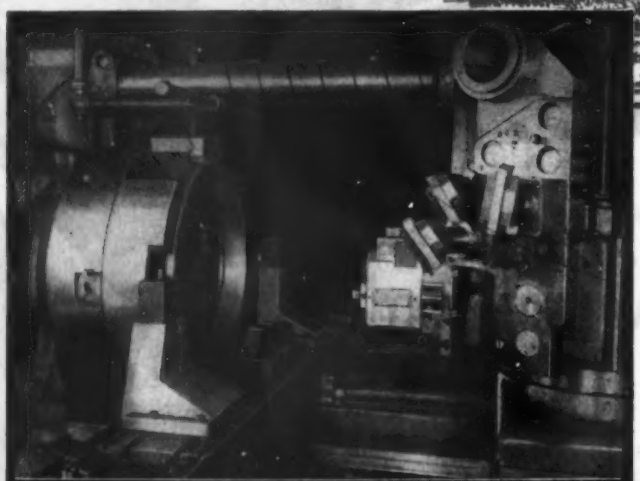
SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

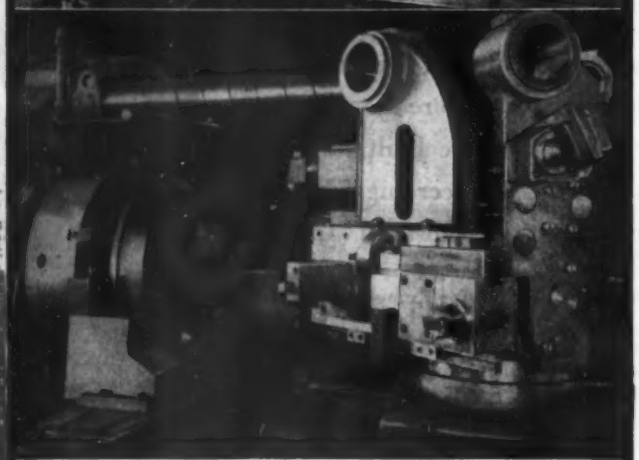


50833

KEMPSMITH
A Famous Name
ON INDUSTRY'S "GAY WHITE WAY"
Tonight, lights will be shining brightly in thousands of industrial plants all over the nation. Forced to operate on strenuous 24-hour production schedules, these plants are doing their share to help speed Victory. In many of them, Kempsmith Milling Machines are playing an important role. Dependable Kempsmith machines, with a rich heritage of more than a half-century of milling machinery experience, are built to take today's strenuous schedules in stride. For sheer ruggedness, power and accuracy, you just can't beat a Kempsmith Miller.
At present, the demand for Kempsmith Milling Machines and Attachments greatly exceeds the supply. However, if you need equipment of this type, write us. We'll do the best we can to take care of your requirements.
THE KEMPSMITH MACHINE CO.
MILWAUKEE 14, WISCONSIN, U. S. A.
★ Precision Built Milling Machines Since 1888 ★

Include P&J RE-TOOLING IN YOUR PLANS FOR RECONVERSION.....





Production [illegible] able to [illegible] quickly in spite of the fact that many new machine tools may not be available when they are most urgently needed.

One answer to this problem of reconversion lies in ability to change over present equipment quickly to handle work other than that for which the original tooling was designed. The tooling set-up on the 8 DXT P & J Automatic for example, for machining flywheels, can be readily changed to make this machine a valuable cost-cutter in the production of other parts.

Owners of P & J Chucking Equipment are, therefore, in an advantageous position because, with P & J machines, re-tooling is practical and profitable and can be worked out in advance of immediate requirements with full assurance that the manufactured parts will be produced at lowest cost.

You are urged to consult with P & J engineers now on your post-war plans and thereby simplify your reconversion problems.

P & J REBUILDING SERVICE

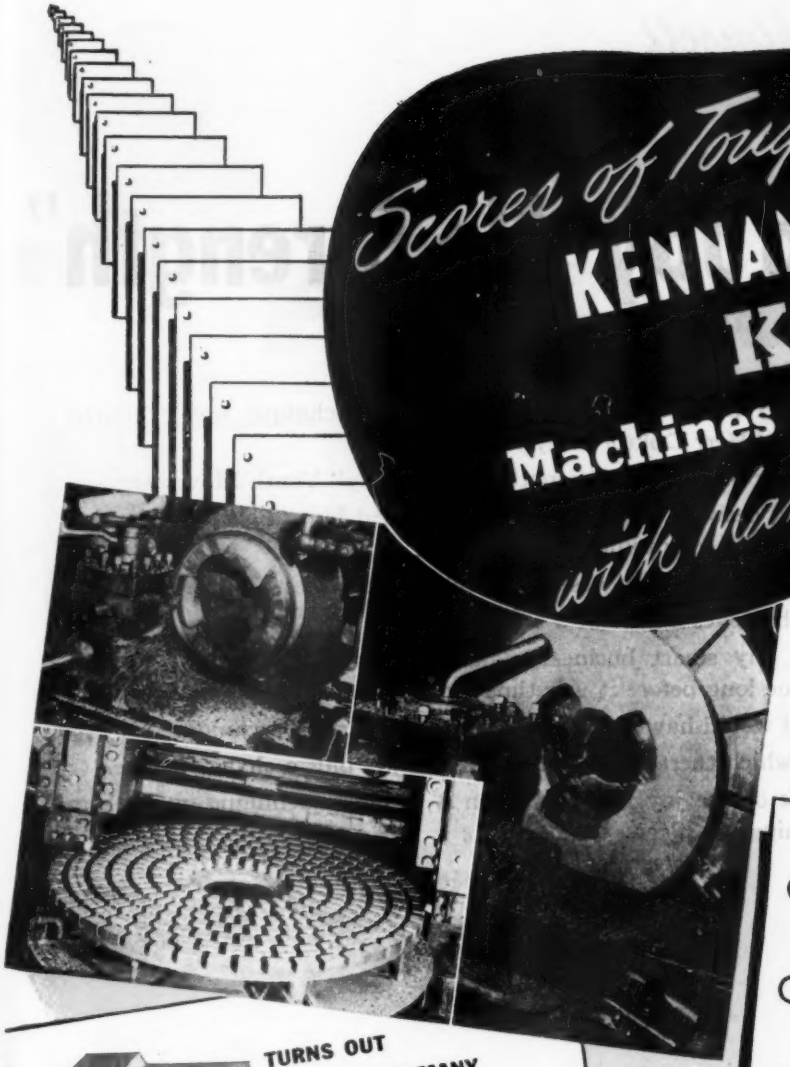
Owners of P & J Equipment should investigate P & J shop facilities for restoring present machines to original accuracy and productivity through rebuilding. A convenient time for re-tooling is available when machines are in our shop for rebuilding.

POTTER & JOHNSTON MACHINE CO.

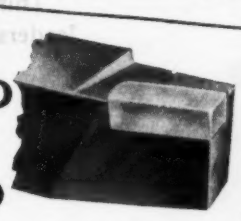
PAWTUCKET, R. I.

THE EXTRA BONDS YOU BUY ARE THE ONES THAT COUNT

Scores of Tough Jobs Prove KENNAMETAL K6 Machines CAST IRON with Maximum Economy

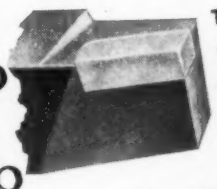


Kennametal Grade K6 is one of the most useful and needed recent developments in tool materials for machining cast iron and non-ferrous metals. It is an improved tungsten carbide having unusual strength in combination with exceptional abrasion-resistance and high hardness. The four performance studies outlined below are typical of scores of comparative service results that clearly show the superior properties of K6 for interrupted and continuous cutting on cast iron.



REMOVES TONS OF METAL FROM CHILLED CAST IRON PARTS, AT TOOL COST OF 74¢ PER TON

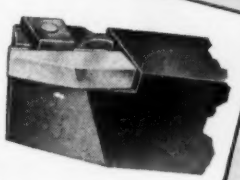
Style 12 Tool with K6 tip turns 1½ lineal miles between grinds! Other makes of carbide failed at all speeds and feeds. After 10 regrinds K6 tip is used on lighter jobs. Operation—turning cast iron piston trunks, 21½" diameter, having six 3" or 4" ports (interrupted cut). Chilled around port holes. Very sandy surface. Feed—.09375". Depth of cut —½" SFM-120.



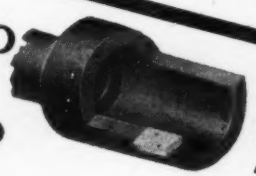
TURNS OUT 10 TIMES AS MANY PIECES, ON ROUGH CASTING, BETWEEN REGRINDS

One to four pieces between grinds was the best performance recorded by other carbides on machining a webbed flange of inferior grade cast iron, having hard spots, and sand pockets. K6 turns out more than 40! Operation—turning outside diameter and facing both sides of hub and rim. Feed —.032" Depth of cut 1/16" to 3/8". SFM-280.

MULTIPLIES OUTPUT, ON FACING OPERATION, ON SANDY IRON CASTING



Replacing another make of carbide with a Style 11HD Tool having a clamped-on, advanceable K6 tip, made possible tripling the feed, doubling the cutting speed, and facing 8 times as many pieces per regrind. Operation—facing sandy iron castings. Feed—.036". Depth of cut—⅛" to 3/16" SFM-180 at start, 320 after tool entered cut.



CUTS 35 PIECES (on Abrasive Electric Iron) AS AGAINST 3 FOR CARBIDE PREVIOUSLY USED

This unique tool, tipped with Kennametal K6, turns out 11½ times as much work between grinds as the carbide tool previously used. Operation—finish trepanning cut on electric iron part. Feed—.003". SFM-210. Accurate tolerances and good finish required, and produced.

The best way to prove that K6 makes possible better, faster machining on cast iron, at lower tool costs, is to try it in your own shop—then compare tool performance and overall costs. Order a few Kennametal blanks, or complete tools, now—and ask our district field engineer, who is fully acquainted with the properties of K6, to help you get maximum results from this *new* and *improved* tungsten carbide—Kennametal Grade K6.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL *Inc.*, LATROBE, PA.

Then he said to himself

"No Joy—No Strength"

HIGH point in faith toward a losing technique was exhibited by "Herr Doktor" Ley . . .

—leader of Hitler's "Strength Through Joy" Youth Movement.

Sitting between two GI's who had frisked him of his cyanide vial, he unjoyfully maintained:

"Adolph Hitler was Germany's greatest man."

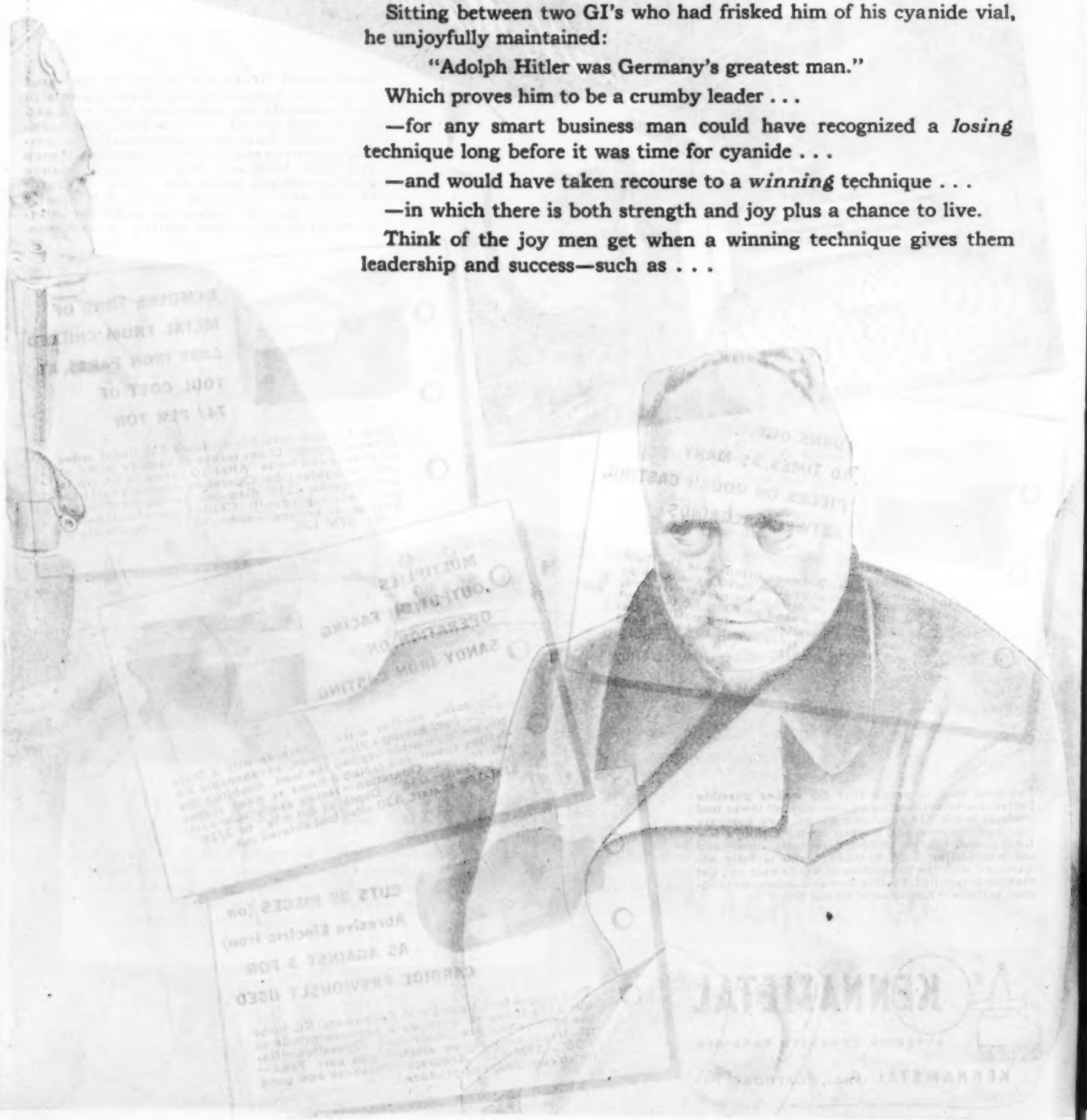
Which proves him to be a crumby leader . . .

—for any smart business man could have recognized a *losing* technique long before it was time for cyanide . . .

—and would have taken recourse to a *winning* technique . . .

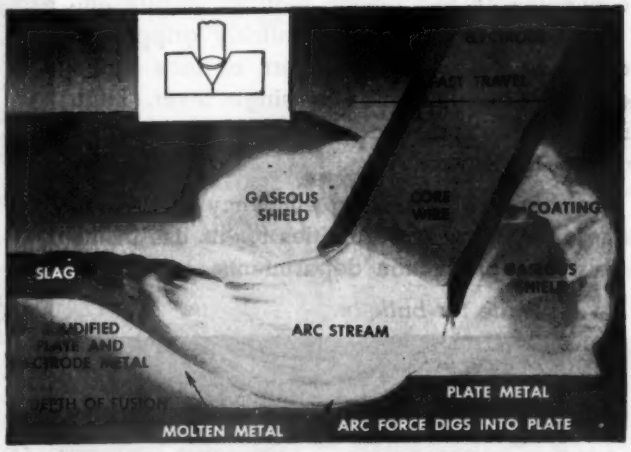
—in which there is both strength and joy plus a chance to live.

Think of the joy men get when a winning technique gives them leadership and success—such as . . .



LOOK, HERR DOKTOR, how to obtain

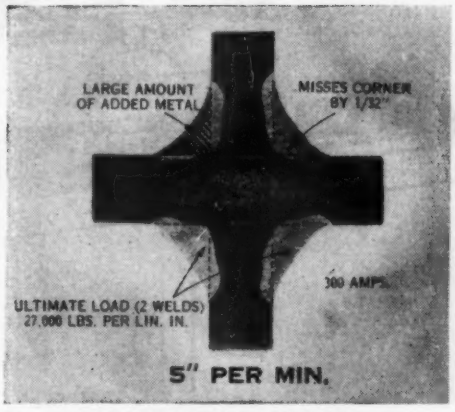
STRENGTH THROUGH "FLEET-WELDING"



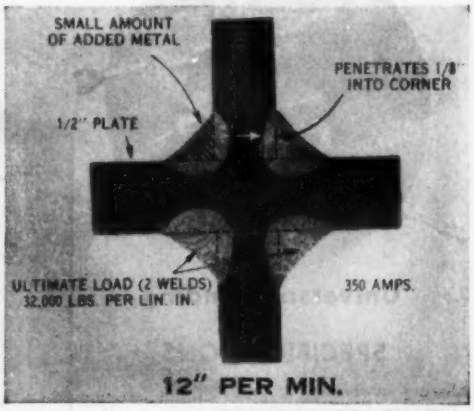
CROSS-SECTION OF ARC IN V GROOVE

Competitive Strength. "Fleet-Welding" utilizes *arc force* to get higher travel speed and greater penetration with less deposited metal. For butt welds in 3/8" plate, speed is 350% higher; cost is 75% less than conventional method.

Physical Strength. Effect of "Fleet-Welding" penetration on speed and weld strength of fillets. Conventional technique gives ultimate load capacity of 27,000 lbs. per lin. inch whereas "Fleet-Welding" gives 32,000 lbs. per lin. inch.



CONVENTIONAL TECHNIQUE


SMALL AMOUNT OF ADDED METAL
PENETRATES 1/8" INTO CORNER
1/2" PLATE
ULTIMATE LOAD (2 WELDS) 32,000 LBS. PER LIN. IN.
350 AMPS.
12" PER MIN.

"FLEET-WELDING"

Handy pocket manual, Bul. 444, gives "Fleet-Welding" procedures for all types of joints and welding positions. Free on request. Ask for it on your business letterhead.

THE LINCOLN ELECTRIC COMPANY • DEPT. I-1 • CLEVELAND 1, OHIO

America's greatest natural **recourse**

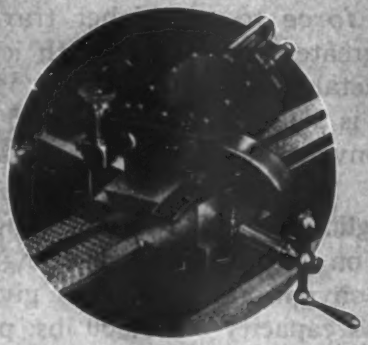
ARC WELDING

918 PLAIN CABINET LATHE

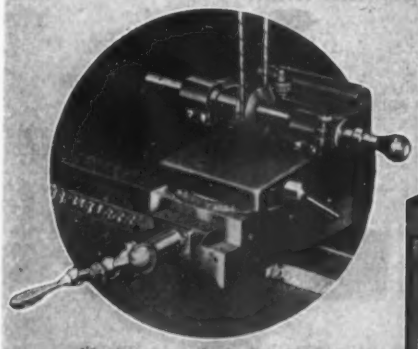
For

Tool-room — Assembly — Production

Spherical Turning



Automatic Turning



Universal Grinding

The Rivett No. 918 plain cabinet lathe is a versatile machine capable of many operations. In addition to the normal lathe functions of turning, facing, boring and drilling, the 918 can be equipped for milling, grinding, slotting and thread chasing.

The operating conveniences and design features assure efficiency on any operation. Work can be quickly gripped in collet or step chuck or mounted on centers or face plate. Selected spindle speeds are controlled by single lever. Built-in accuracy, correct spindle speed and dynamic balance guarantee finish to closest tolerance.

The machining capacity and producing efficiency of the 918 plain cabinet lathe open many opportunities for its use in the tool-room, assembly and production departments.

Write for bulletin.

SPECIFICATIONS

Swing over bed, dia.	9"
Distance between centers	18"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	8"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1⅛"
Slide rest, travel of tool post slide	5¼"
Slide rest, travel of cross slide	5¼"
Tailstock spindle travel	3½"
Spindle speeds, eight forward and reverse.	
Low range	150-2500 r.p.m.
High range	225-3750 r.p.m.
Weight of lathe, mounting and drive, net	850 lbs.

RIVETT

RIVETT LATHE & GRINDER, Inc.

BRIGHTON • BOSTON • MASS. • U. S. A.

SUPER IN PERFORMANCE

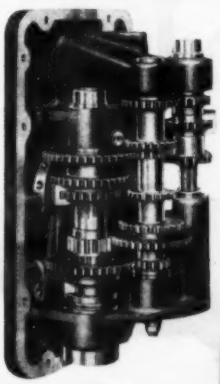
Outstanding performance under the pressure of war—now available to the uses of peace.

Cincinnati Bickford Super Service Radials will serve you well in competitive peace-time production.

The Air Preheater Corporation says: "Despite a round-the-clock schedule, a cost saving of 25% was effected by Cincinnati Bickford Super Service Radials."

Easy operation and steady performance were important factors here.

Write for detailed Bulletin R-24A



The eighteen feed changes are made through selective sliding gears controlled by two convenient levers. Every gear of the feed unit is of heat-treated alloy steel and every shaft is multiple splined. This construction stands out in marked contrast to the previously accepted spring dive-key feed mechanisms. A safety gear protects against overload.

Equal Efficiency of Every Unit Makes the Balanced Machine.

• *See our condensed Catalog in Sweet's File*

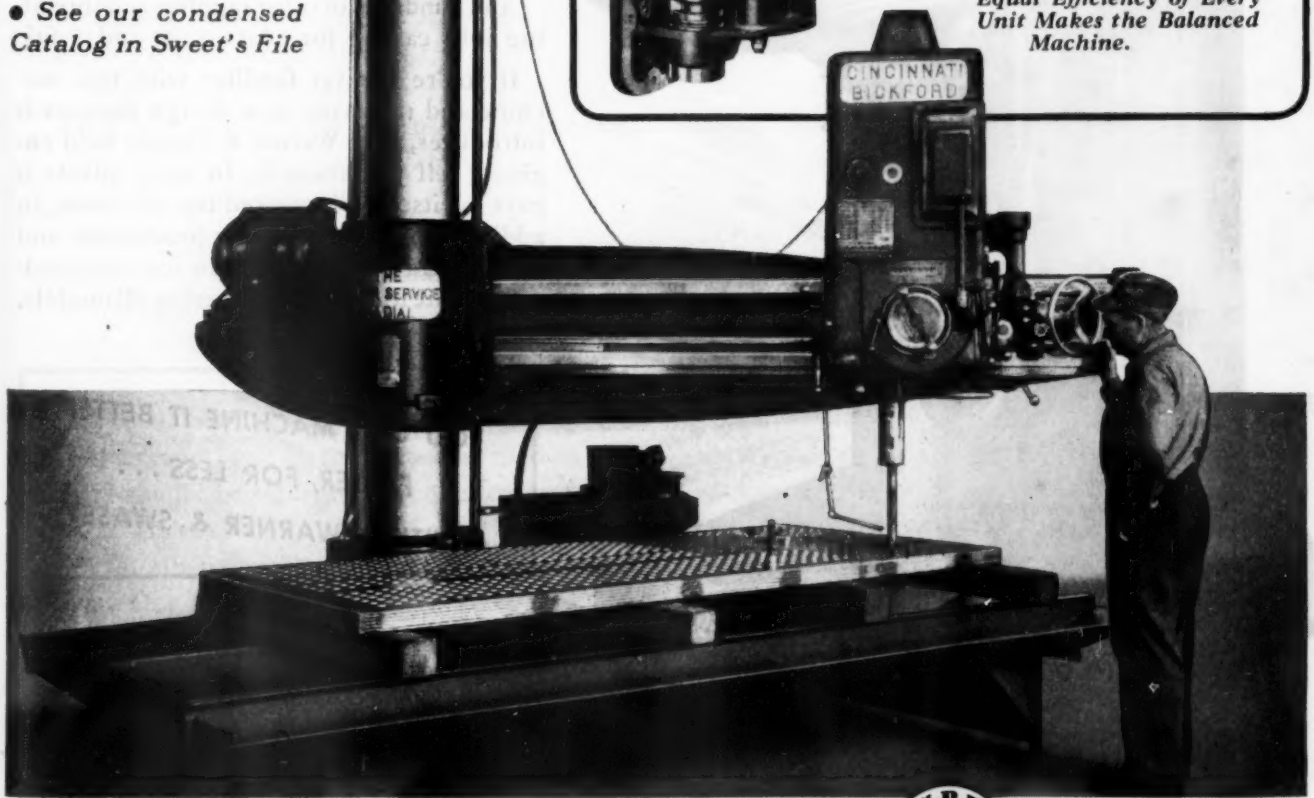


Photo: Courtesy of Air Preheater Corporation

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9, Ohio U.S.A.**

CUT COST 74% ON CLASS 3 TAPPING JOB!

A WARNER & SWASEY Precision Threading and Tapping Machine solved a tough tapping problem for a large New Jersey electrical manufacturer—*and cut cost 74%!*

The job was to tap twenty-four 5/16" 18-pitch Class Three Threads in large steel rings 48" in diameter. Because a spoiled thread on any of the 24 holes would scrap the job, it was formerly broken into two operations—rough tapping by machine; finish tapping by hand. Tapping cost was high—$23.00 per hundred.

But when a Warner & Swasey No. 11 Precision Tapping and Threading Machine was installed, costs were slashed to $5.95 per hundred! And the job is now done with only one operation.

The continuing accuracy of the exclusive Warner & Swasey lead screw principle using solenoid actuated guide fingers is responsible for the success of the Precision Threading and Tapping Machines on this and hundreds of other tapping and threading jobs calling for Class 3, 4, and 5 fits.

If you're not yet familiar with this machine and the many new design features it introduces, let a Warner & Swasey field engineer tell you about it. In many plants it pays for itself in increased tap life alone, in addition to effecting better production and cutting scrap losses far below former standards. Write for a catalog covering all models.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

The No. 11 Warner & Swasey Precision Threading and Tapping Machine. Capacity 8-36 to ¼". Other models ranging from 0-80 to 2½".

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, SADDLE AND RAM TYPES · CHUCKING AND BAR TOOLS · PRECISION TAPPING AND THREADING MACHINES

For Quick Reconversion

ONCE again great events bring the nation's machine tool and tool and die industries into sharp focus.

As we strain to return to mass production of peacetime goods with the least delay, we come up against the fact that mass production is impossible without key production equipment and without special dies, tools, jigs and fixtures.

Fortunately the machine tool industry has been working on postwar orders for several months, with Washington's blessing. So a real start has been made toward furnishing such important customers as the automobile industry with their requirements.

The big job the next few months will be to see that manufacturers get the essential equipment without which there can be no sizable production of goods.

The tool and die industry has had an unexpected load thrust upon it and will have more as the year wears on. The key to its volume of output will be the number of skilled men that it can muster in its shops.

It must not lose any more skilled workers to the services, and its experienced men in uniform should be returned to the industry as soon as possible.

Two other factors bear upon quick reconversion. One is the prompt clearance of plants by the Army and Navy. The other is construction at the earliest date of the new plants that certain industries must have if they are to reach the production level that they foresee the next few years.

It is true that plants and equipment in this country today are plentiful, but they are not always of the right kind in the right place.

Reconversion Director John W. Snyder points out that plants and equipment are only one of the nation's four main resources from which the wealth of our economy springs. Manpower, raw materials and managerial know-how are the other three.

Manpower we shall have in abundance. Raw materials, with a few exceptions, will be available as needed. Our managerial know-how, which directed skillfully the production of the largest volume of war goods ever turned out by any nation or combination of nations, already is switching its talents to peacetime requirements.

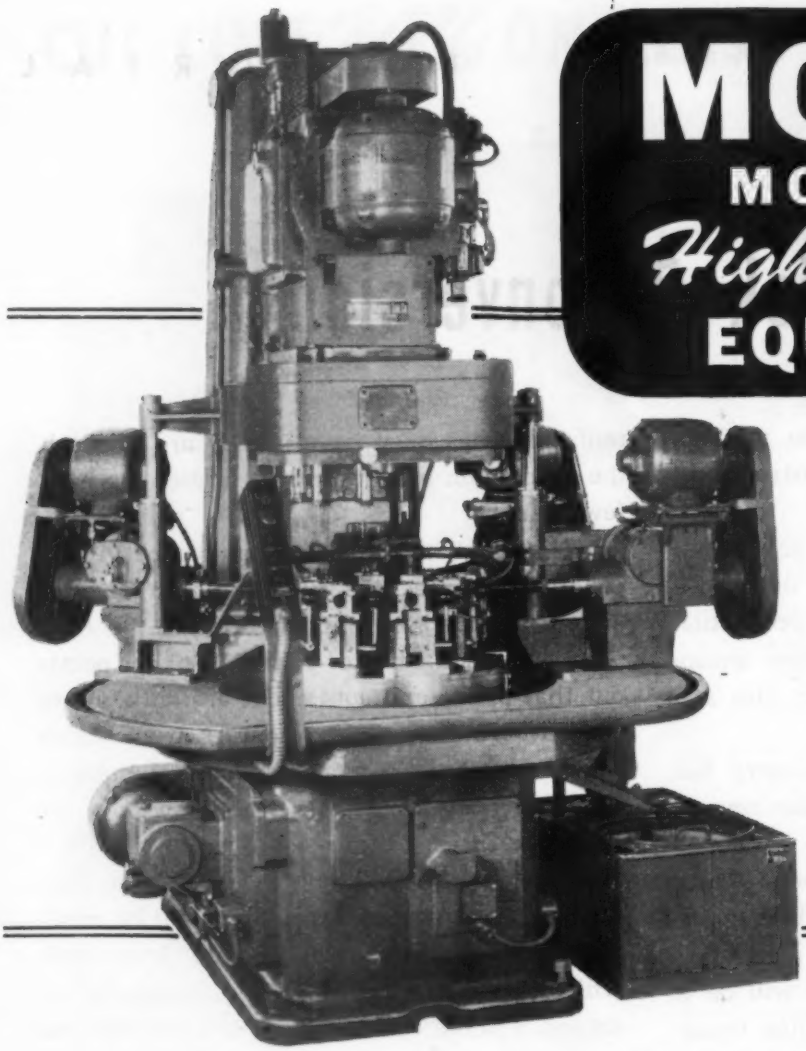
Above everything else, in the critical months ahead, government, industry and labor must pull together if the unemployment period is to be shortened to an irreducible minimum.

Full employment is of paramount interest to all three groups. It can be achieved only by tolerance and by an understanding approach by these groups working as a unit.

"The same energies, the same skills, the same cooperation that won the war," observes Mr. Snyder, "must now be directed toward the winning of a total and stable prosperity in peace."

Burnham Finney

MORRIS
MOR-SPEED
High Production
EQUIPMENT



A SEVEN SPINDLE VERTICAL MACHINE WITH THREE HORIZONTAL SIDE HEADS

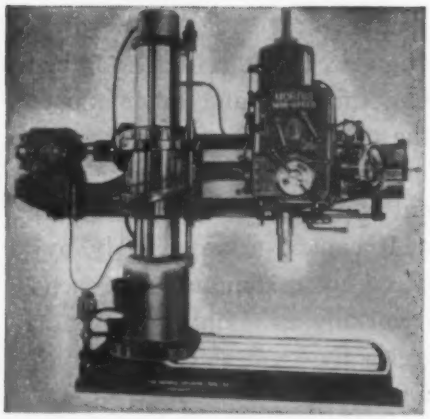
● Here is an example of Morris Engineering "know how" in developing the use of standard units to meet specific job requirements.

This seven spindle vertical machine has three horizontal side heads mounted on the platen. It has been developed to drill oil holes in a steel gear.

The three side heads drill one long hole in the center of the gear by making three passes—one at each of the three stations. The 3 H. P. foot mounted motor drives the vertical hydraulic unit and vertical head.

On all vertical machines, the side heads mounted on the platen have individual motor drives and are fed from the vertical hydraulic unit through a rack feed to each head. This method keeps all head feeds synchronized throughout the machine cycle.

The side heads can be mounted in any position to take care of horizontal as well as angular holes. The tap heads are independent units and can be mounted horizontally—vertically—or at an angle. They have a screw feed assuring accurate thread leads and a reversing motor drive controlled by the machine cycle. Coolant system may be mounted on the side when necessary.



MORRIS MOR-SPEED RADIAL

Consult Morris Engineers on high production equipment. They can help you.

Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.

CINCINNATI 3, OHIO

Latin America's Industrial Expansion Boosts Demand for Machine Tools

BY J. SEWARD McCAIN AND GEORGE LOINAZ,
BUSINESS PUBLISHERS INTERNATIONAL CORPORATION

The heavy potential demand for machine tools by Latin America is indicated by this broad analysis, based upon two careful surveys and industrial investigations in 13 of these nations

LATIN-AMERICAN metalworking industries have expanded to an unprecedented degree under the impact of war, and this has had a direct effect upon the requirement for machine tools. More than that, metalworking operations now being undertaken in Latin America will demand much more specialized equipment, including precision production tools, besides the general purpose machine tools forming the bulk of Latin-American plant equipment.

During the war a great deal of equipment was needed for replacement and plant expansion at a time when all major sources of supply were either cut off (Germany and other European nations) or unavailable due to their own war requirements (the United States and Great Britain). This has resulted in a huge accumulation of deferred buying throughout Latin America. Some idea of the potentialities of this demand may be gained from studies of the results of several surveys taken by the Business Publishers International Corporation, supplemented by basic industrial reports highlighting the development and expansion of Latin-American metalworking industries.

Twenty-eight manufacturers' representatives in 13 Latin-American countries estimated their immediate postwar requirements at 4,055 machine tools, according to a B.P.I.C. survey. At an average value of $4,500 per unit, this represents over $18,000,000 in potential machine tool business. Although this only covers a few of the total number of manufacturers' representatives handling machine tools in Latin America, the results are even more startling when it is considered that in 1938 total Latin-American imports of machine tools amounted to $7,354,315, of which the United States supplied $2,500,477, or 34 percent.

Of further significance is the fact that the United States will probably supply the bulk of these tools to Latin America. This conclusion is based upon a logical study of all available indicators.

To begin with, the prewar distribution of this tool market was as follows:

LATIN-AMERICAN IMPORTS
(Machine Tools-1938)

From	% of Total
United States	34%
Germany	50%
United Kingdom	8%
Others	8%
TOTAL	100%

In view of Allied plans to strip Germany of much of her industrial equipment, it is obvious that she

will be out of the Latin-American tool market for quite some time to come. This will leave the United States and Great Britain competing for the lion's share of the market. However, it must also be considered that Germany's postwar position will leave her unable to supply the large European needs for machine tools, thereby making that area a particularly lucrative and close market for the British. Great Britain probably will find the Continent a splendid outlet also for her surplus tools (although Britain has agreed not to export surplus U. S. lend-lease tools, she may and will export surplus British tools).

Aside from this factor, the British may be expected to exert every effort to maintan their domination of Empire markets by seeking to meet all needs for machine tools and similar equipment of the Empire. The British will do well to retain their prewar position in the Latin-American tool market.

So far as the United States is concerned, its immediate postwar position in the Latin-American market shapes up better than ever before. Aside from the elimination of German competition, and the probable preoccupation elsewhere of the British, our situation is greatly aided as a result of the accumulation of huge dollar balances in Latin America during the war due to heavy U. S. imports of raw materials from those areas. Latin America entered 1945 with assets of $3,500,000,000 in gold and bank credits, the largest in the history. These nations thus have the wherewithal to buy badly needed equipment to push planned industrialization programs, besides helping them to take care of accumulated replacement needs.

This means that the postwar Latin-American tool market shapes up something like this:

LATIN-AMERICAN POSTWAR IMPORTS

From	% of Total	Change form Prewar
United States	84%	+147%
Germany	0%	—100%
United Kingdom	8%	0
Other	8%	0
Total	100%	

With respect to the "other" nations, it is doubtful that any of the prewar suppliers of the Latin-American tool market will be able to expand their positions.

Getting down to the specific types of tools required in Latin America, the Business Publishers International Corporation has two separate surveys as indicators of the relative diversity of the demand. The survey of the manufacturers' representatives referred to earlier in this discussion, indicated specific need for the following items:

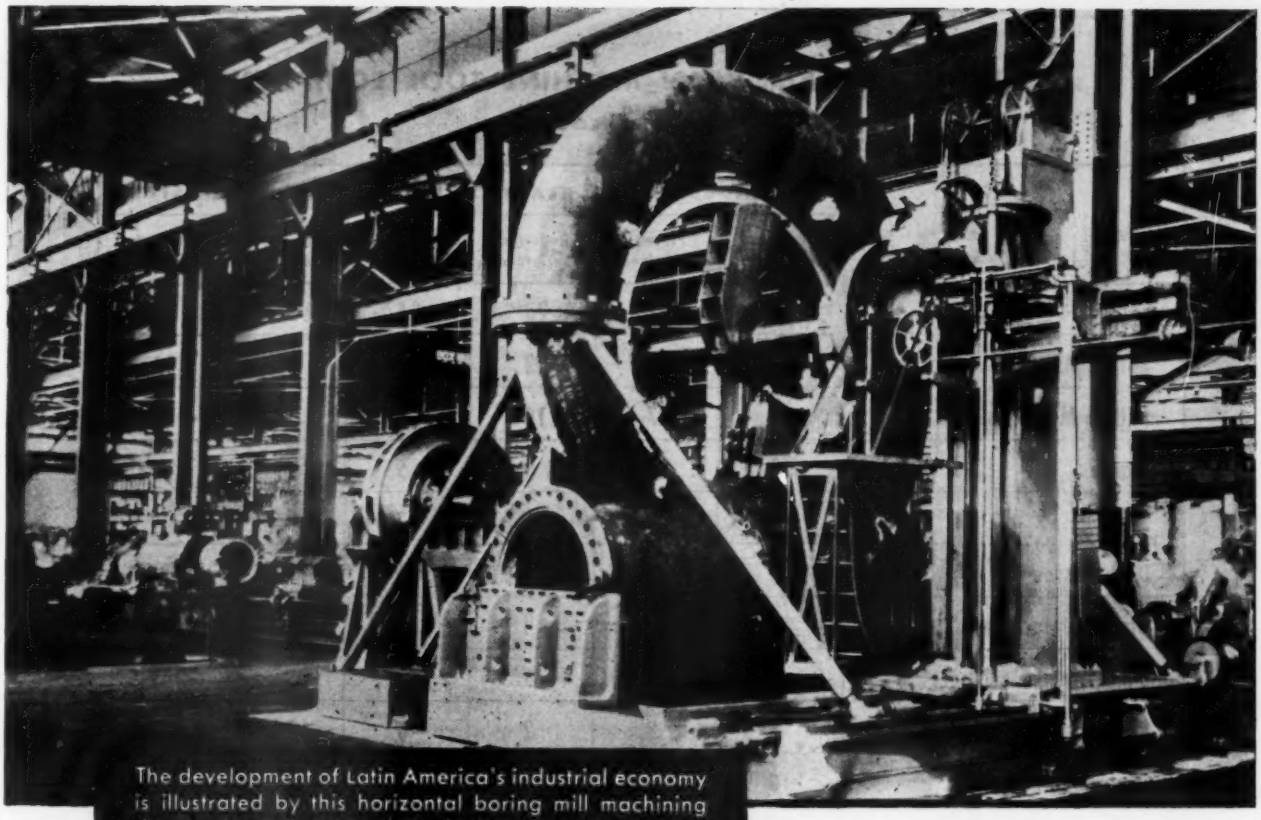
Machine Types	No. Needed	%
Lathes	1,432	35.3
Drill Presses	1,100	27.1
Sheet Metal Mach.	234	5.8
Grinding Machines	230	5.7
Planers	210	5.2
Shapers	180	4.4
Milling Machines	168	4.1
Boring Mills	131	3.2
Broaching Machines	124	3.1
Power Saws	118	
Screw Machines	58	2.9
Gear Cutters	38	
Power Punch Presses	20	3.2
Reaming Machines	12	
Total	4,055	100.0%

TABLE I: LATIN-AMERICAN POSTWAR MACHINE TOOL DEMAND

ALL FIGURES IN PERCENTAGES

	LATHES	DRILL PRESSES	SHEET METAL MACHINERY	GRINDING MACHINES	PLANERS	SHAPERS	MILLING MACHINES	BORING MILLS	POWER SAWS	OTHERS
Argentina	38.71	46.09	....	8.76	1.07	1.07	0.92	2.16	0.15	1.07
Brazil	33.08	15.39	0.77	5.39	7.69	7.69	4.61	1.54	7.69	16.15
Chile	34.89	11.62	23.26	....	4.65	....	4.65	11.63	4.65	4.65
Colombia	66.93	9.73	5.84	....	6.23	4.28	4.28	1.94	0.77	....
Ecuador	68.76	12.51	....	2.08	2.08	6.25	4.16	4.16	....	....
Mexico	49.49	5.73	1.13	8.08	4.19	3.78	5.01	2.96	4.60	15.03
Nicaragua	31.95	27.78	....	....	13.89	....	9.72	....	13.89	2.77
Paraguay	14.28	....	....	....	14.28	14.28	14.28	....	14.28	28.60
Peru	40.80	38.28	1.44	4.34	2.16	2.16	3.24	2.16	1.44	3.98
Puerto Rico	25.00	10.72	1.79	12.50	10.71	1.78	6.25	12.50	6.25	12.50
El Salvador	37.50	....	....	37.50	....	....	12.50	....	....	12.50
Uruguay	16.80	....	....	36.80	24.00	....	9.60	....	9.60	3.20
Venezuela	11.09	53.84	10.77	0.85	5.76	10.77	3.64	0.95	0.42	1.91
Total	36.00	27.00	6.00	6.00	5.00	4.00	4.00	3.00	3.00	6.00

From reports submitted by twenty-eight manufacturers' representatives



The development of Latin America's industrial economy is illustrated by this horizontal boring mill machining the steel scroll case of an hydraulic turbine in the Rio shops of Brazilian Traction, Light and Power Co.

A breakdown of these requirements by countries is shown in Table I. This partial sampling serves the important purpose of indicating the wide range of the equipment currently needed by manufacturers' representatives in 13 countries. It also points to the probabilty that all manufacturers' representatives are being deluged with thousands of similar inquiries as the 28 firms covered in this survey.

To get an idea of the relative needs for such equipment by types, another survey was taken among representative industrialists in ten Latin-American nations. These businessmen reported the types of present equipment operated, on a percentage basis to their total equipment, and showed the types of equipment required, on a percentage basis to their total needs. The results of this survey are shown in Table II, which provides a good idea of the nature of the postwar market for various types of tools in Latin America. These figures indicate the diversity of equipment sought by both light and heavy industries, and are considered more representative of market conditions than the reports from manufacturers' representatives.

These survey indicators are further backed up by a conservative analysis of Latin America's position with respect to machine tools from an overall standpoint. After all, Latin America has been unable to import any machine tools from Great Britain, Germany and the United States for the past three-and-one-half years, except for a few items needed for defense purposes and to sustain the essential civilian economy. If Latin America merely required during those years a similar amount of tools for replacement and expansion as the pre-war 1938 year, this would indicate an accumulated unfilled need for some $25,000,000 in machine tools, as a rock-bottom figure.

Prewar Finances Poor

However, the 1938 purchases of machine tools were limited by the critical financial position of most Latin-American nations. This is in sharp contrast to their present ability to buy. Moreover, the immediate postwar period will provide many of these nations with the first opportunity they have ever had to execute the sweeping plans for greater industrialization that many of them have been working on for a long time.

Another factor that must be considered is the ability of some Latin-American nations to produce a limited number of their own tools. To some extent, such production has been stimulated by the inability of these countries to secure replacement tools, although it is probable that greater progress has been made in the production of replacement parts to keep worn equipment in fair operating condition.

The most spectacular development along these lines has taken place in Brazil, where current annual production of machine tools is estimated around $5,000,000 (prewar normal U. S. output was around $200,000,000 —the wartime peak in 1942 was $1,320,000). About 75 percent of this production is centered around Sao Paulo. Although most of the machines are copies of imported designs, the list of tools being domestically produced is quite impressive: lathes, drill presses, stamping presses, gear cutters, power metal saws, shapers, planers, and grinding and milling machines.

Machine tools are being produced in Mexico, although it cannot be said that there exists such an industry. Some attempts have been made in the past for its establishment, but thus far they have not succeeded. Isolated cases point up recent developments: The National

TABLE II: LATIN-AMERICAN MACHINE TOOL EQUIPMENT

PRESENT AND REQUIRED

	ALL INDUSTRIES		HEAVY INDUSTRY		LIGHT INDUSTRY	
	Required Equipment	Present Equipment	Required Equipment	Present Equipment	Required Equipment	Present Equipment
Lathes	27%	27%	28%	26%	24%	30%
Boring Mills	17	17	12	19	22	11
Milling Machines	10	7	10	5	10	11
Planers	9	6	9	5	9	9
Shapers	6	3	7	3	5	4
Drill Presses	6	7	6	6	6	11
Grinding Machines	4	3	4	2	3	4
Sheet Metal Machinery	3	16	5	22	1	2
Power Saws	5	8	2	6	10	12
Others	13	6	17	6	10	6

From reports submitted by representatives of durable and non-durable goods manufacturers in ten Latin American countries

Railways' largest shop has manufactured forging machines to produce hot forged rivets. Two metalworking companies, one in Mexico City and another in Monterry, have produced lathes on a small scale with a maximum length of 65 inches and 20 inches working diameter. Industria Mecanica Manuel Suarez is planning to make milling machines after the war, but so far only models have been produced.

Other Mexican-made machine tools include: shapers, boring mills, drills, and so on, mostly copies from imported models. This production has been termed defective and is not expected to survive foreign competition.

Prior to 1939, machine tools were not produced in Argentina. Expansion of local industries when imports were cut off spurred production of some of the simpler types of machine tools, and eventually lead to manufacture of more complicated machinery. At present, Argentine plants are producing lathes, planers, drill presses, milling machines, shapers, and such items as wire-drawing machinery and pipe-making machinery. Although these products are reported to be of fair quality, they are regarded as inferior to American or European tools. The Argentine Census reported that 1,530 metal-working machines were produced domestically in 1941, with an estimated value of $620,228. In view of Argentina's position as one of the leading industrial nations of South America, it is obvious that such production is woefully inadequate, even if it were to be maintained postwar.

Nevertheless, the desperate need for machinery in Argentina right now is indicated by a report from a leading sales agency there: "The frantic demand from all parts for metal goods has been tremendous. It has been so large that some shops here have successfully manufactured and sold a number of machine tools they have made. Locally made milling machines have sold for the equivalent of more than $10,000 in U. S. currency, which is a lot of money to pay for a machine which is not up-to-date in design, and in size is about a No. 3."

Development of domestic machine tool production has naturally been of even lesser importance in the smaller and less industrialized nations of Latin America, such as Colombia, Ecuador, Nicaragua and Costa Rica, even though reports from distributors in those countries reflect a similar dire need for machine tools as that existing in Brazil, Mexico and Argentina. As a whole, indications point to the probability that such production of machine tools as has been brought about due to the wartime inability to import better and more desirable foreign models may decline postwar, rather than increase, once normal shipments to Latin America may be resumed.

Considering these various facets, it is unlikely that there will be any revolutionary change in the types of machine tools required by Latin America postwar than prewar, although there will probably be a slight, accelerating advance in the proportion of high production precision tools. Of course, American equipment producers may be called upon to supply items formerly imported from Germany. In addition, it is expected that there will be a tendency to use general purpose tools for more more complex work.

Some of the highlights of the industrial progress and expansion in Latin America, underlying its heavy postwar needs for machine tools, will be outlined in our next issue.

Cost Control System Pays Own Way In Holding Production Expenses Down

BY CHARLES DELMAR TOWNSEND, PROCESS ENGINEER

BUSINESS in the postwar period will be more competitive than ever. Every manufacturer will find it necessary to cut his manufacturing costs to a minimum in order to produce his product at a competitive figure and meet competition.

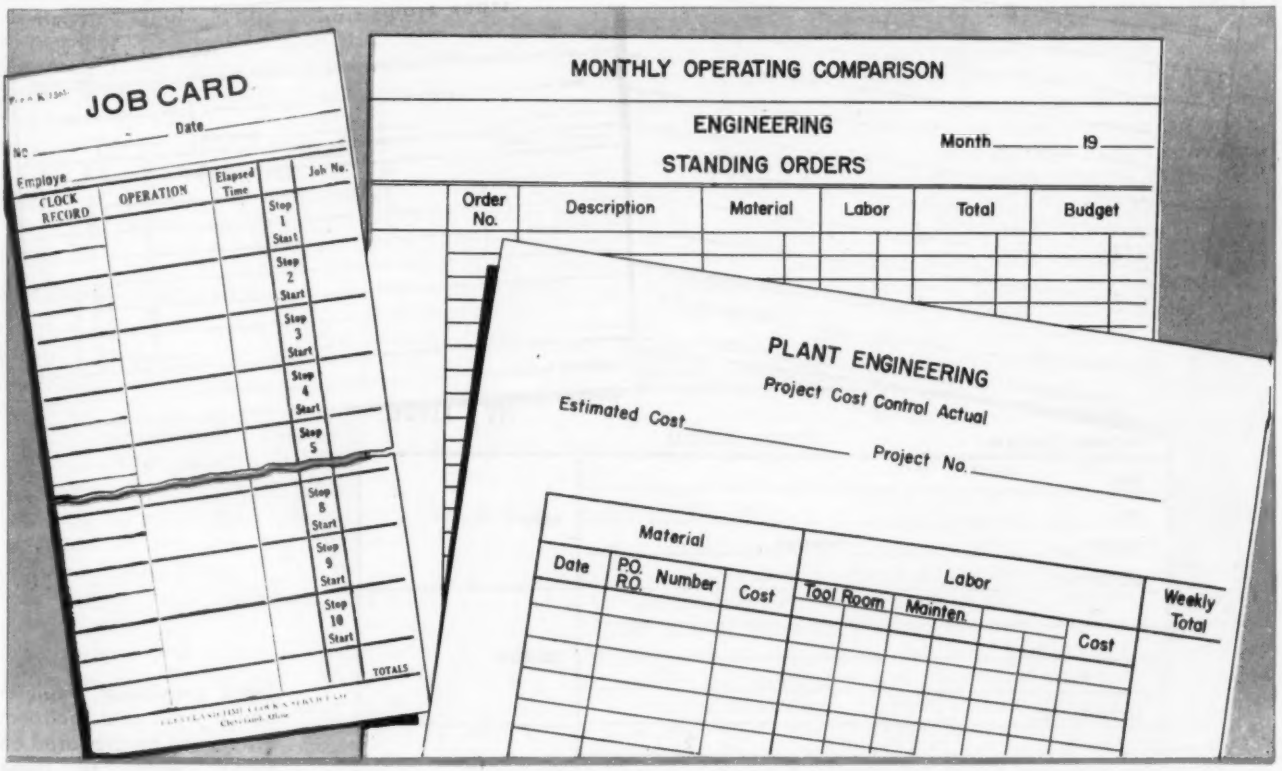
The establishment of a cost reduction department to handle the various problems of reducing manufacturing costs will aid any manufacturer to establish basic costs and produce a satisfactory product at the lowest possible expense.

There are many adaptations of cost reduction control in any business. One such adaptation is the use of a budget and cost control on maintenance work to assist in keeping equipment repairs in line. The

Cost reduction program serves as a check on maintenance and toolroom expenditures. Often it uncovers repair costs which warrant machine replacements

analysis of the control sheets will often indicate that certain pieces of machinery are being repaired frequently and that the cost of such repairs is more than the price of a new machine. Oftentimes tools are still being used that have become obsolete and such tools can be scrapped and newer models substituted which will be a saving to the company.

Nearly every concern which uses a budget to operate its departments has a special set-up for accumulating the costs. The following description indicates the securing of such information independent of the cost accounting department. This outline is applicable to any department that wishes to keep a record of expenditures. It is not designed to give the actual cost down to the last cent since the basic wage is an average hourly rate for the maintenance department based on the weekly hours worked by the department. A similar average rate is used for the toolroom. Overhead figures can be so employed if desired. It is well to



Each employee in the maintenance and toolroom divisions fills out the job card. It gives a complete working record, including a description of the work and idle time

Standing orders are recorded by a clerk on the project cost control sheet. All costs are recapitulated at the end of each week and totals are made at the end of each month. The monthly operating comparison sheet reveals the allowed budget against actual expenditures. These monthly comparisons offer means of detecting excessive costs and controlling them

remember that if overhead is not included the picture is not accurate and costs cannot be compared with work done by outside contractors.

The work to be done by the maintenance department is split into various groups. Numbers are assigned to each job and the list is known as standing work orders. This work has to be done by the maintenance department or toolroom sometime during each month. The money allotted to these jobs includes labor, material and overhead. This is the budget for that work. It is based on operating experience as to how much has been spent in the past. After a few months of operating on a budget it is often possible to reduce the budget figure to an amount closer to the actual operating expense.

All maintenance and toolroom work is recorded on job cards made out by each man. These cards are handled as follows:

1. Job cards are delivered to maintenance and toolroom supervisors with worker's name, number and date on the card.

2. All time during the shift must be accounted for.

3. Enter proper job number and description of work, noting asset number of machine.

4. Enter lunch periods.

5. Always punch in when starting a job and punch out when job is completed.

6. Enter any idle time under proper job number. This covers all time waiting for work or hold-up when job cannot be started.

7. All job cards must be signed by the assistant foreman or the foreman and then turned over to the supervisor of the department.

8. Job cards will then be sent to the cost control clerk for posting on the project cost control form.

The cost control clerk sets up a control sheet for each of the standing orders. On this sheet is entered the following information:

1. Show budget figure for work order beside estimated cost. Enter standing order number beside project number.

2. Enter all material used noting purchase order number or stock requisition number in proper column.

3. Figure cost of material on stock requisitions.

4. Enter all cost of material both purchased and stock.

5. Enter daily from job cards the hours spent on the work order.

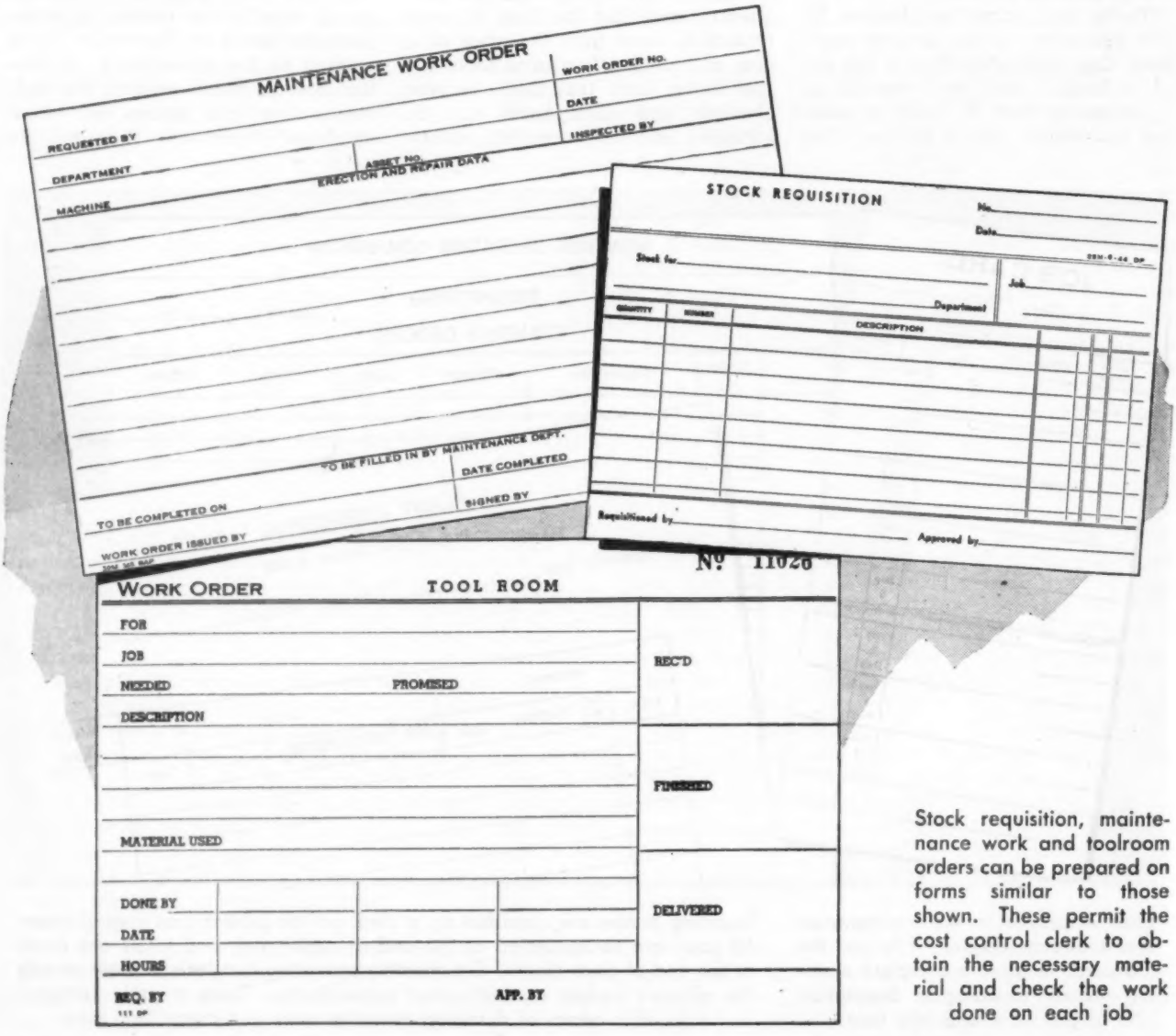
6. Each week make a recap of all costs.

7. At the end of each month total all expenditures for further posting.

When the monthly operation comparison sheet is properly filled out it gives at a glance the actual expenditures and the allowed budget. This sheet is obtained in the following manner:

1. This is a recap of all standing orders.

2. Fill in order number and descriptions.



Stock requisition, maintenance work and toolroom orders can be prepared on forms similar to those shown. These permit the cost control clerk to obtain the necessary material and check the work done on each job

3. From project cost control form enter material cost for the month.

4. Under labor enter cost of labor taken from project cost control form.

5. Total material and labor and enter in proper column.

6. Enter budget figure taken from project cost control form.

It is necessary for the cost control clerk to have all stock requisitions, maintenance and toolroom orders clear through his department in order to be able to obtain correctly the material and check the actual work done on each job. An outline of this follows:

1. All stock requisitions must come to the cost control clerk. The items should have unit cost of material against these items drawn from stores.

2. Maintenance orders when completed will be sent to the cost control clerk for checking.

3. Toolroom work orders will be sent to the cost control clerk when completed.

It has been found helpful to extend this cost control work a little further than usual. Since it is always good practice to have a complete list of all capital equipment within a plant, it is also wise to know how much is spent on each piece of equipment. A card file is set up, listing the equipment along with other pertinent information. The back of the card forms a record for repair data. This record is filled in from information received from maintenance orders and stock requisitions for the work done on the machine. The same idea is carried out on all special tools, dies and such items.

Summary of Repairs

At the end of each month a summary of all repairs for all machines and tools maintained that month is recapped on the monthly machine and tool repair sheet. This sheet is made up as follows:

1. At the end of each month a recap of all machines repaired will be made on the monthly machine and tool repair form.

2. Enter asset number in the proper column.

3. Original equipment cost is taken from the equipment file.

4. Describe the machine as recorded on the equipment file.

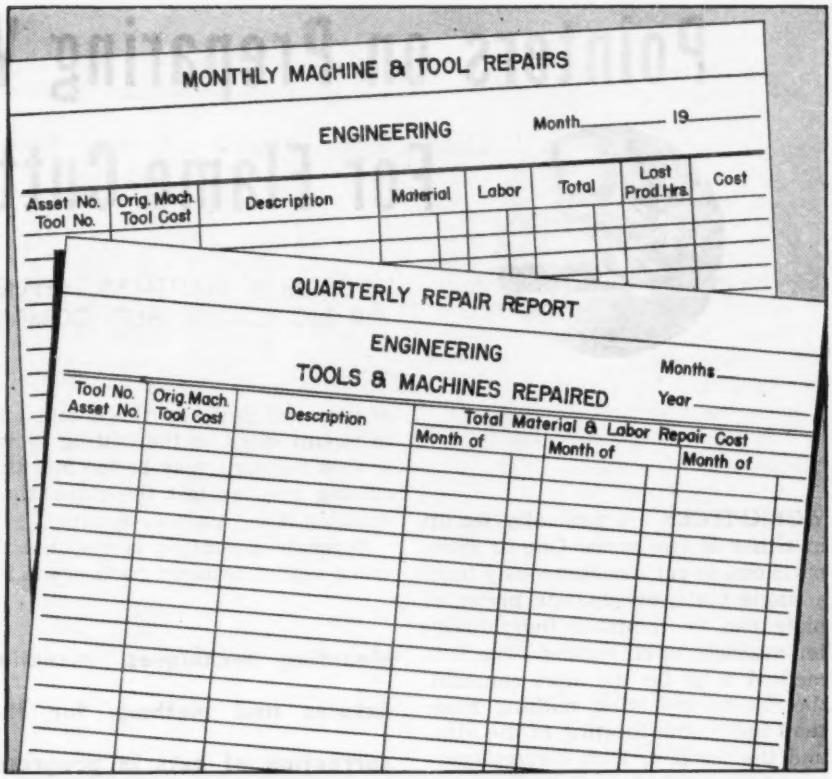
5. Enter material and labor in proper space from back of equipment file.

6. Enter production hours lost by repair of machine (from column on back of equipment file). This is the difference between date when machine was started for repairs and when it was returned to service.

7. The cost of production downtime can be figured by using an average hourly rate or base figure for production costs.

8. Follow the same procedure for all tools repaired.

To obtain a better picture of any one machine it is suggested that at the end of each quarter a report of all machines and tools repaired during the three-month period should be made. This quickly gives the repair trend and serves as a guide in scrapping equipment.



MONTHLY MACHINE & TOOL REPAIRS

ENGINEERING Month_____ 19____

Asset No. Tool No.	Orig. Mach. Tool Cost	Description	Material	Labor	Total	Lost Prod. Hrs.	Cost

QUARTERLY REPAIR REPORT

ENGINEERING

TOOLS & MACHINES REPAIRED Months_____ Year_____

Tool No. Asset No.	Orig. Mach. Tool Cost	Description	Total Material & Labor Repair Cost Month of	Month of	Month of

Monthly machine and tool repairs are made on the sheet above. This sheet gives an over-all picture of a machine's productivity and the cost of material and labor for its operation. The quarterly repair report gives concrete information on the trend of repairs and can be of real service in determining the equipment that merits replacement

High Costs Spotted Easily

When this system of cost comparison is established it is possible to study the high points and make plans to eliminate them. Maintenance work that is expensive sometimes can be reduced by redesign of equipment or purchase of new machines. Repairs that cost more than the machine is worth can be spotted easily by a monthly review of the control sheets. In this way, manufacturers' representatives can be consulted to assist in determining the basis for such high repair costs and other steps can be taken to keep expenditures in line.

With the coming of postwar competition no company can afford to overlook ways and means to reduce overhead and thereby lower the final manufacturing costs of the product. Budget controls established as a part of a cost reduction program can help to reduce excessive costs. Such a budget control when properly operated introduces many other avenues for further cost reduction.

A cost reduction department would properly be under the supervision of a graduate engineer specifically trained in this type of work who also has a broad knowledge of manufacturing processes and procedures. The reduction of costs becomes the responsibility of the cost reduction department which should work harmoniously with the cost accounting department. Machinery will be studied and improved, plant layout will be checked and raw materials investigated. Coordination of these items under one department and as part of a cost reduction program will bring about additional savings to a progressive company interested in producing quality products at the lowest cost.

Pointers on Preparing Workpieces For Flame-Cutting Operations

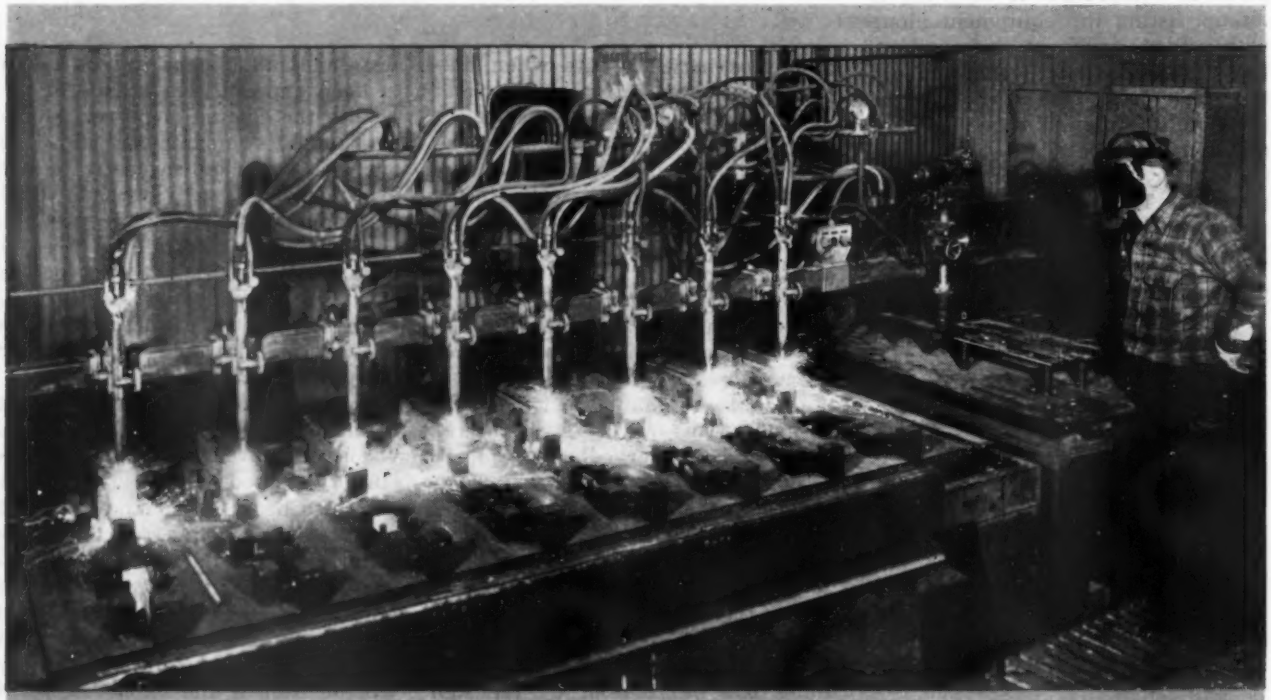
BY DR. G. V. SLOTTMAN, APPLIED ENGINEERING DEPARTMENT, AIR REDUCTION SALES COMPANY

Mounting techniques, essential fixtures and methods for the correction of cuts in progress, are discussed in this article, fifth in a continuing series

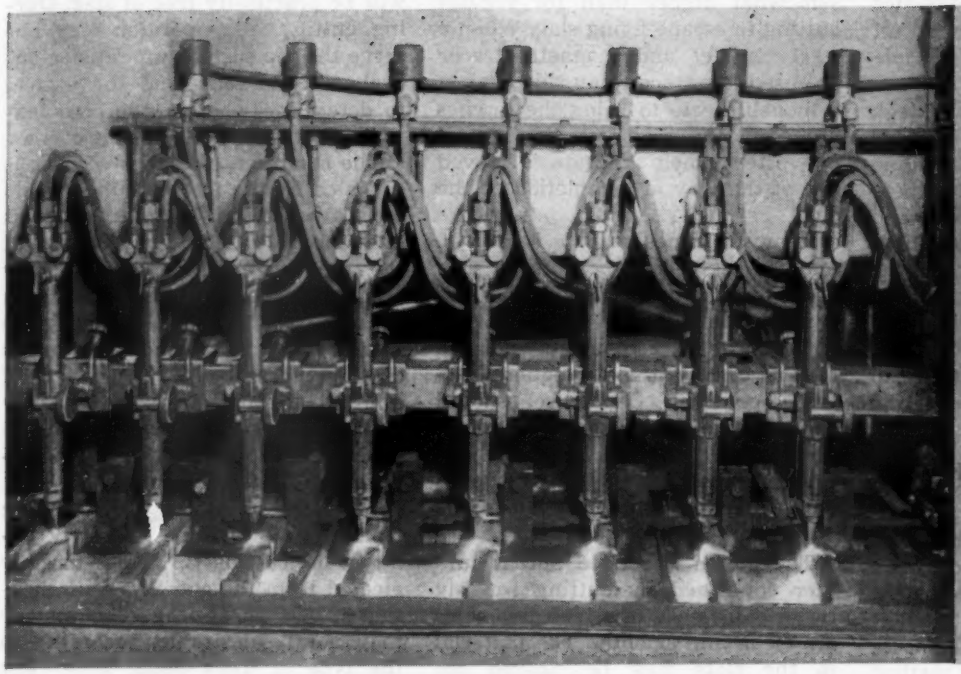
WORKPIECES are generally set up in either of two ways. One or more parts can be cut simultaneously from a single plate, or separate pieces of plate can be mounted individually for multiple torch cutting. The first method is by far the more common, the set-up involving nothing more than the proper locating of the plate and the templet, with correct spacing of the torches, so that all torches will make their cuts within the plate and leave a minimum of scrap. A good practice in production cutting of identical parts by this method is to mount stops on the cutting table, so that the plate may be fed into the cutting area against the stops, thus spotting it for successive cuts.

Separate mounting is resorted to when semi-fabricated parts are to be cut in multiple. Some form of jigging arrangement is necessary to hold the pieces at the proper spacing and to keep them in line with each other, so that all torches will impinge their preheating flames on the edges of the pieces at the designated starting point. The jigs must be securely located so that handling of material on and off for successive operations will not alter their positions. Likewise the jig should provide secure support of the workpiece, and often of the scrap as well in cases where falling scrap might result in an untrue contour or jarring of the work.

Locating stops on the jig should



This worktable has been set up for production cutting of hatch beam sockets with an Oxygraph. Eight jigs in foreground hold flame-cut lengths of billet in exact position for cutting a U-slot in each block. Pieces rest on steel pins and are fitted against stops at left side and front. Openings cut in bed of table accommodate sparks and slag. Rear row of jigs, similar to those in front, hold blocks in position for beveling of corners at right angle to slots. Two steel templets, one for each operation, are fastened to posts on tracing table at right. Work factor of this set-up is high since material can be handled while cutting is in progress



Another method for jigging individual workpieces for multiple torch cutting. A transverse shaft with spring-loaded pressure lugs is located immediately behind the torch tips and forces the bars to the left against stops. The torches have completed their traverse and are cutting the pieces off. Bar stock extending far out to the rear will then be moved up on rollers, clamped, and the cutting operation repeated. Special solenoid valves at top provide instantaneous shut-off of cutting oxygen

always bear against the pre-finished surfaces of the work, those to which the flame cuts must stand in fixed relation. Contrariwise, it is evident that these stops should never bear against surfaces which will become part of the scrap, since this would provide no enduring support of the final part. Central finished openings may thus be used for clamping parts to receive outside cuts, or outer surfaces used for locating inside cuts. In either case the method of support should be such that the scrap is free to move due to the heat of cutting, without such movement affecting the position of the workpiece. When necessary, the bottom supports should be made with openings to permit sparks and slag to pass through.

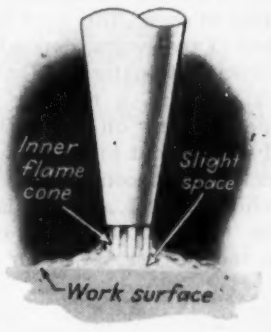
Adjustments Before Cutting

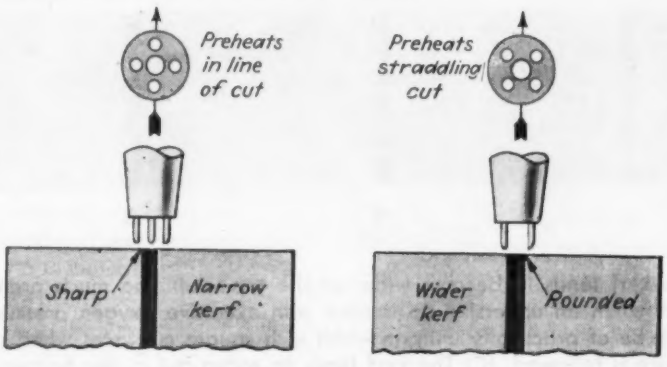
When the equipment and material have been set up, the operator makes his final adjustments preparatory to actual cutting. The preheating flames may be adjusted to neutral or somewhat oxidizing, and the torch is raised or lowered so that the inner flame cones just clear the top surface of the steel material. Excessive distance between tip and plate reduces cutting speed, while too short a spacing will result in melting and rounding of the top edges of the cut.

It is not possible, however, to specify in inches a tip distance which will apply to all tips, since the length of preheat flames varies with different tips and pressures. It is preferable, when using a four-flame tip in perpendicular cutting, to have the tip positioned with one preheat flame leading and one following on the line of cut. This arrangement, where it is practicable, will produce a narrower kerf and sharper top edges than will be obtained with the preheats straddling the cut. It is beneficial on straight-line or rectangular work, but not in cutting curved contours, where the alignment cannot be maintained. The straddling position is preferable, however, in making bevel cuts. Tips having six or more preheats need no such care in positioning.

Cutting oxygen pressure adjustment should be made with the torch valves open, since the pressures listed in cutting tables represent flowing pressures. Due allowance should be made, particularly on multiple torch set-ups, for pressure

Cutting tip should be elevated (right) to leave a short gap between the preheat flames and the work surface. When practical, the preheat orifice should be aligned as shown directly below with two flames in line with the cut to secure clean cut edges and narrow kerf. When preheat flames straddle the cut (below, right) the kerf becames slightly wider and the top edges slightly rounded. Too little space between tip and work also tends to produce rounded edges. This straddling position is correct for bevel cutting





drop betwen the supply regulator and the torches, if the length of passage between the two is considerable.

When preparing to cut scaly steel, it is sometimes desirable to remove the top surface scale along the line of cut before cutting to avoid possible loss of cut. This is often done by moving the torches in a quick traverse over the line of cut with the preheat flames ignited to pop off the scale. Extremely heavy scale may require the similar use of a multiflame descaling or heating torch to provide a clean steel surface for the action of the preheats.

Methods For Starting Cuts

The method for starting a cut is generally the same as described previously in the installment on hand cutting. Cuts may be started at the edge of the piece or from a drilled, punched or flame-pierced hole inside the outer contour. The latter method may be used either through necessity, for cutting inner openings, or as a means of controlling distortion by arresting movement of the piece being cut. Flame-pierced starting holes should preferably be made with a hand torch rather than the machine torch. An oxygen lance should be used to cut holes on heavy sections. Generally, sections more than 6 or 8 in. thick should be lanced.

Piercing with the machine torch is sometimes resorted to in multiple cutting for the sake of expediting the work by making all necessary pierces at once. This may be done in either of two ways, depending upon thickness of material. On material such as 1 in., a running pierce is made, starting on the inside scrap and moving out toward the cut line. Penetration becomes deeper as the torches progress, and is usually complete after about ½-in. of travel. The torches are set at an elevation somewhat higher than for regular cutting to escape flying slag. When a steel templet and magnetic tracer are used, the tracer may ride against a movable gate to bring the torches out from the pierce to the line of cut, after which the gate is moved out of the way of completion of the cut.

Heavy thickneses up to 6 or 8 in. may be pierced with multiple machine torches, but on production jobs it is preferable to use a different set of torches and machine for piercing than is used in the subsequent cutting operation. Otherwise, should one or more of the piercing torches become clogged with slag, the entire progress of the work would have to be interrupted to clean the orifices of the affected tip.

The pierce is started and is further continued by cutting roughly rectangular slots of which two sides are clean and smooth. The material in the slots may be cleared out more readily by giving a reciprocating motion to the torches manually as they progress forward on the last lap of the operation. The size of slot need not be large. On 4-in. material, for example, penetration is complete after about one inch of travel, and the slot can be made about 1¼-in. long by ¾-in. wide. Then, when starting the production cut, considerable preheat is imparted in a washing motion in case the slot positions do not correspond exactly with torch positions. This excess preheat will sustain ignition even though the several cutting torches do not make contact with an edge at the same time.

Once the cut is started the speed of travel should be adjusted to balance with the oxygen pressure to produce the desired drag length. The key to this is the appearance of the slag discharge at the bottom of the kerf. In a short drag cut the bottom will be practically free of slag. During cutting, the operator may observe the top surface for satisfactory preheat conditions, and the bottom to determine whether the combination of pressure and speed is correct.

The condition of excessive drag is revealed by the fact that the stream of sparks issuing from the cut is considerably behind the position of the torch over the work, as may readily be observed by looking at the cut from the side. This gives warning that the speed is too great or the pressure too low, and that if allowed to continue, the cut may cease to penetrate. Correction can be made by decreasing speed or increasing oxygen pressure.

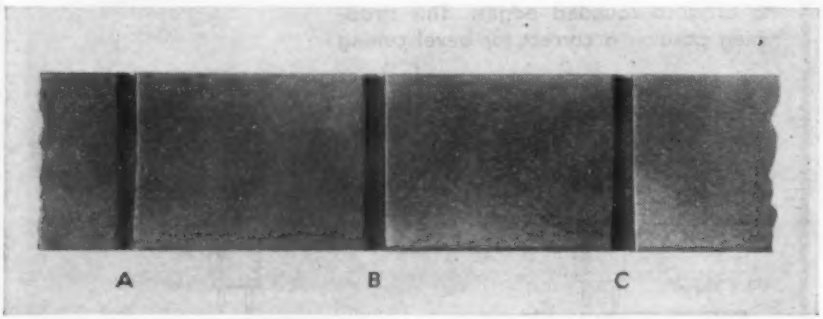
When the stream of sparks issuing from the cut is almost directly beneath the cutting tip and is forcibly ejected from the cut, it is an indication of very short drag. This may or may not be desirable, according to the type of work being done. For precision or shape cutting, no change need be made, but for ordinary cutting this condition denotes wastage of oxygen and should be corrected by reducing the oxygen pressure or increasing the speed.

Rapid Appraisal Steps

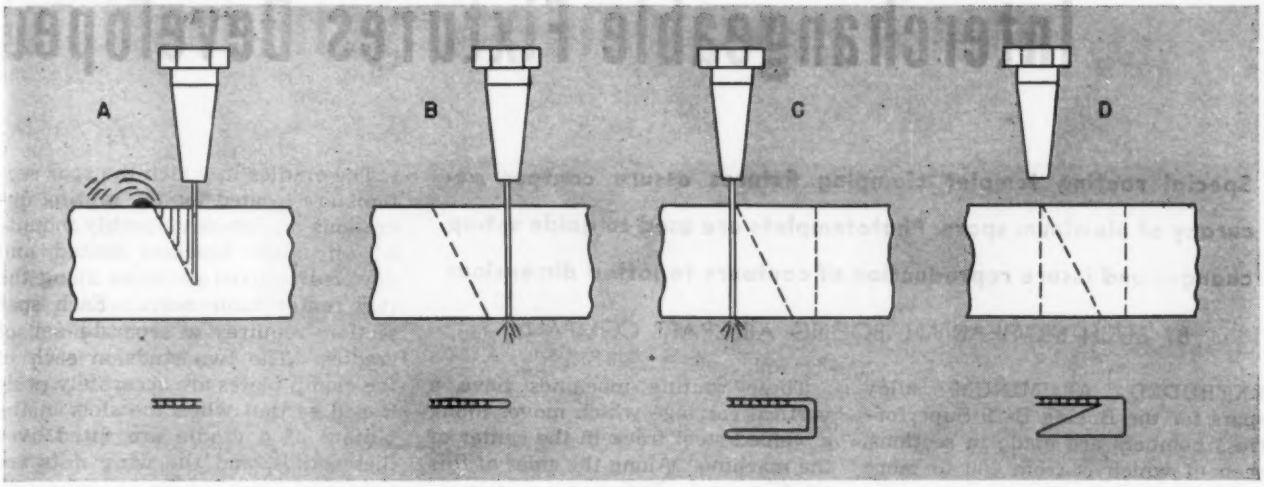
The proper relations for standard cutting produce a fan-like array of sparks hugging the bottom surface, spreading out in a forward direction and to either side. Immediately behind this spray of sparks is the heavy slag, gathering in large globules which lazily droop and detach themselves. Another indication of satisfactory conditions is the sound accompanying the operation, resembling the sound of slow and steady ripping of canvas. While this may appear to be an unscientific means of judging a practical set of conditions, it is meaningful to an experienced operator and presents a rapid method of appraisal.

When correct procedure has been followed, the kerf width will be practically constant from top to bottom, and the sides of the cut will therefore be nearly perpendicular. Excessive drag in cutting tends to cause the bottom of the kerf to be wider than the top while the opposite condition is created if preheat is excessive or if a small size tip is used with too much oxygen pressure.

The narrowing of the kerf toward the bottom indicates an insufficiency of oxygen at that level, because of contamination of the oxygen or reduced activity of the oxide, and can be overcome by using a larger tip



(A) The kerf tends to become wider at the top when too much preheat is used, or when an undersize tip is used with excessive oxygen pressure. (B) Kerf will be of practically uniform width with square cut faces when correct procedure is followed. (C) The kerf tends to widen out at the bottom when the drag is too long. Cut may be lost when this condition prevails



In piercing with multiple machine torches, steps *A* and *B* are sufficient when the same torches are used for piercing and subsequent cutting of comparatively thin material. All four steps should be followed in piercing heavy materials, making small slots of rough rectangular shape having two clean edges and faces for starting and inside cut. Side and top views are shown

size to increase the volume of oxygen. In heavy cutting, however, this must be done with caution, because excess oxygen may cause the kerf to bell out at a point between the top and bottom of the cut, due to swirling of the gas within the cut.

When job requirements call for a practically constant kerf width, the cutting operation becomes more critical, and it becomes difficult to prescribe the effect of slight changes in operating variables. In general, a larger tip size and somewhat lower oxygen pressure help to give a straight kerf. However, the surface condition of the steel, the preheat value, speed, pressure and tip size all influence the kerf condition, and the proper settings can only be determined by trial and error on each particular job. This procedure will assure conditions that will produce clean cuts with little dressing.

Precision cutting will be discussed in the sixth installment of this series. The cause and effects of thermal expansion will be covered, with some recommendations for its control.

Quick Acting Clamp for Holding Work Securely

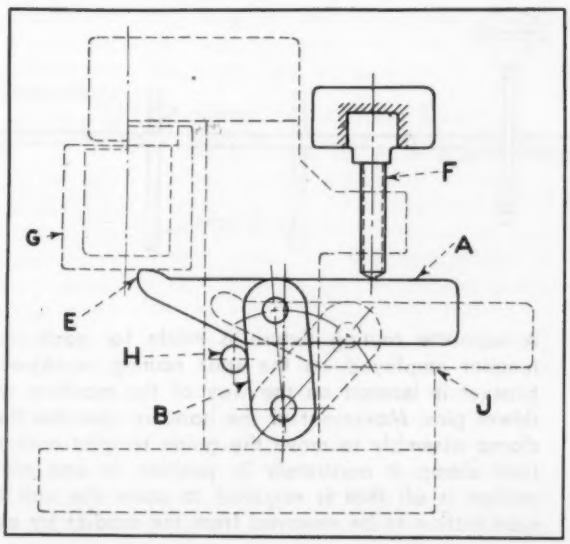
BY FOSTER B. ELLIOTT

WHERE SPACE is limited and a method is required for supporting work firmly in position, the usual design must be varied to suit conditions.

Here is a case where the workpiece must be supported in a fixture while the machining operations take place.

The principle involved is a lever, pushed down on one end by a thumb screw, which is elevated at its other end and supports work in position. To get the supporting lever out of the way for removing and replacing work, the fulcrum is carried by a link fastened to the fixture. This link makes it possible to move the lever out of the way of the work. When work is placed in position, the lever rotates about the link bearing pin until the link strikes a stop pin in the fixture. This stop pin must be located so that, when the lever is in position, the fulcrum of the lever is beyond the center of the link bearing pin.

The clamp *A* is hinged to the parallel link *B*. The end of clamp *A* supports the work at *E* and the screw *F* exerts its pressure on the clamp. Thus, when holding the work *G* in its proper place, the links are forced against the pin *H*. When the screw *F* is released, the clamp *A* swings back to position *J*, releasing the work and providing clearance for removal. Tightening the thumbscrew serves to hold the lever off center and increases the pressure against the work.



The center of the link pin is off center of the supporting lever; pressure from the thumbscrew holds the work in position. Release of the thumbscrew permits quick removal of the workpiece

Interchangeable Fixtures Developed

Special routing templet clamping fixtures assure contour accuracy of aluminum spars. Phototemplets are used to guide set-up changes and insure reproduction of contours to lofted dimensions

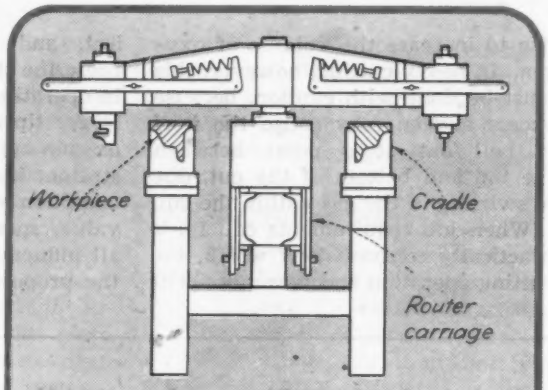
BY LEON MOORADIAN, BOEING AIRCRAFT COMPANY

EXTRUDED ALUMINUM alloy spars for the Boeing B-29 Superfortress bombers are made in sections, each of which is from 100 to more than 350 in. long. These sections are completely machined in a special department at the Renton Division of the Boeing Aircraft Company. The quantities involved, because of the intensive production program for B-29 bombers, has made it desirable to develop several special units for some of the machining operations on these parts.

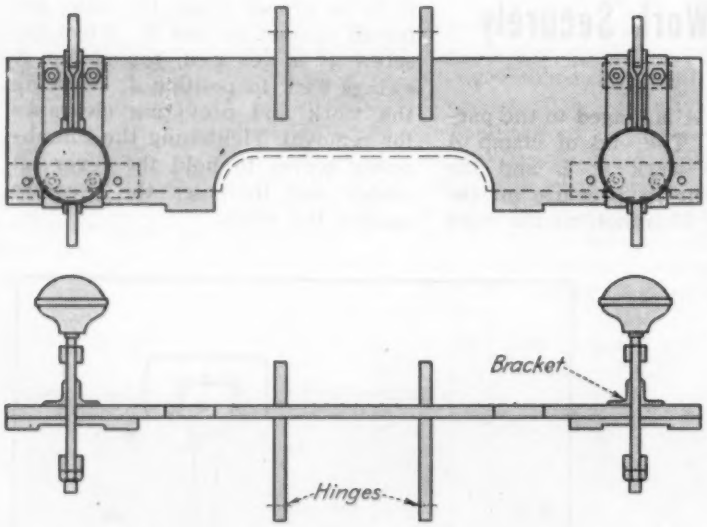
Most of the spar sections for the Boeing B-29 bombers require special cut-outs in the flanges. These cut-outs are machined on special traveling head router units developed by Boeing tool engineers. Single and double head routing machines are employed, depending upon the operations involved.

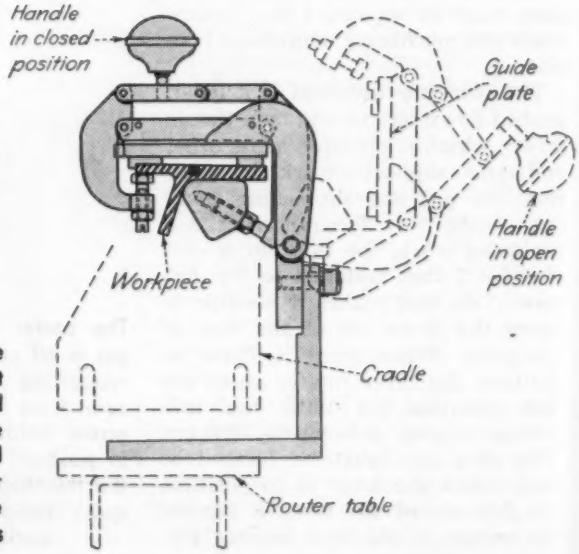
These routing machines have a vertical carriage which moves along a welded steel track in the center of the machine. Along the sides of this track are two fixture support ways on which are mounted support cradles to position the spar sections during the routing operations as well as templet guide fixtures to locate the several cut-outs. By providing two work set-up ways, cradles for right- and left-hand spars can be set up at the same time. Furthermore, set-up operations for one type of section can be in process while routing operations on another spar section are in process at the other side of the machine.

The cradles in which the spar sections are located for the routing operations are interchangeably mounted on angle brackets bolted and doweled in fixed positions along the two router table ways. Each spar section requires a separate set of cradles. The two studs in each of the clamp plates are accurately positioned so that when the slots in the bottom of a cradle are fitted over these studs, and the wing nuts are tightened, each cradle is accurately aligned with its clamp plate. This feature permits locating one or more guide templet fixtures along the table way on fixed dowel pins so that



Single and double-head routers have been developed for operations on B-29 wing spar chord sections. Only one arm can be used at a time on the double-arm machines, but this design permits keeping two types of cutters setup at all times

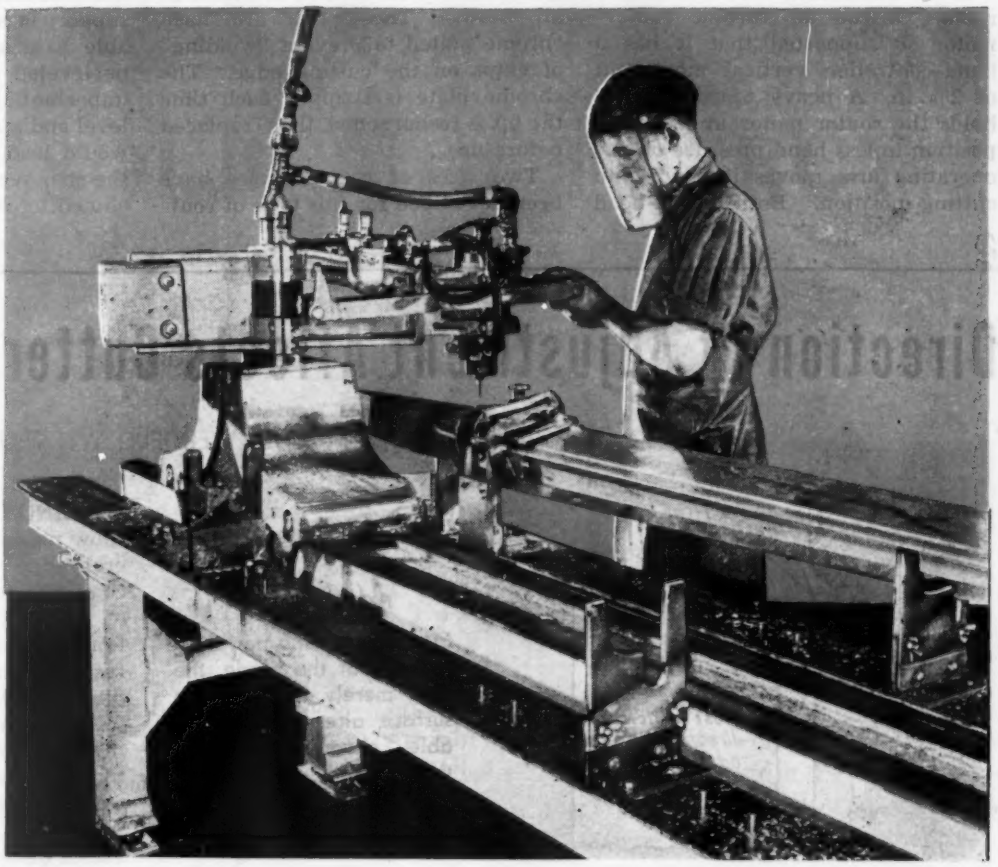


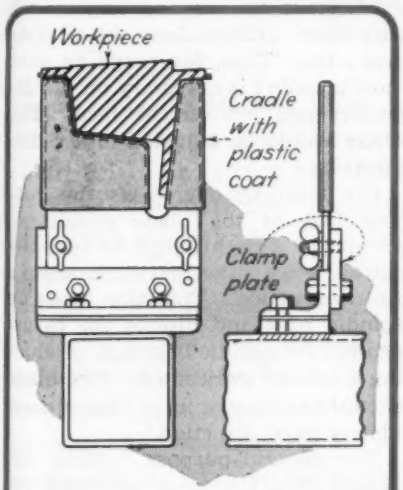


A separate routing fixture is made for each standard guide templet employed on the spar routing machine. The support bracket is located on the way of the machine with bolts and dowel pins. Movement of the handles operates the links of the clamp assembly to move the guide templet onto the work and then clamp it accurately in position in one motion. Another motion is all that is required to open the unit to permit the spar section to be removed from the cradles by overhead hoists

For Machining Superfortress Spars

Long router tables, having a center rail on which the router carriage can be moved, have been developed at the Renton plant of Boeing Aircraft Company for machining operations on spar sections for Boeing B-29 bomber wings. By providing two table ways, routing operations can be performed on one side of the machine while a new set-up is being made along the other side. Accurate longitudinal location of the spar chord sections in the cradles is insured by the use of fixed locating stops





Support cradles are cut from 1/4 in. thick steel plate and covered on the work contacting surfaces with plastic material to prevent marring the surfaces. These cradles are accurately located on clamp plate assemblies bolted and doweled to pads welded to the table way surface of the routing machine

it will be in correct relation longitudinally and transversely with the spar section to be routed. The cradles are ¼ in. thick steel plates cut out to properly support the spar section for which they are made. Then, the upper portions of these cradles are coated with an ethyl cellulose plastic to prevent scratching or otherwise damaging the surfaces of the spar sections when they are placed in the cradles. The spar sections are located longitudinally in the cradles between fixed and screw-clamp end stops.

The guide templet fixtures are designed so that one motion of the operating handle opens or closes the fixture and, at the same time, operates the clamps which hold the guide templet against the top surface of the spar section. An accompanying sketch indicates the toggle action of the links which control the action of the clamping elements in these fixtures. The support brackets for these templet fixtures are accurately drilled for dowel and bolt holes to match similar holes pre-drilled in the table ways of the machine.

Each tooling set-up on one of these routing machines is made according to a set-up templet drawing reproduced as a phototemplet which is given to the set-up man in the department for reference when changing set-ups on these machines. These phototemplets show the location of the fixtures, end stops and cradles on both sides of the machine for standard tool set-ups.

Carriage Re-built for Spars

The carriage which supports the router motors was adapted from a previously developed design for the carriage of a rail-type drilling machine made for the production of B-17 bombers in the Boeing plant. It has eight ball-bearing rollers on which it travels along the ways of the support beam. Each roller is mounted on an eccentric shaft, making it possible to position accurately the carriage with relation to the ways and to adjust the rollers for wear. In converting this carriage for use on traveling-head routing

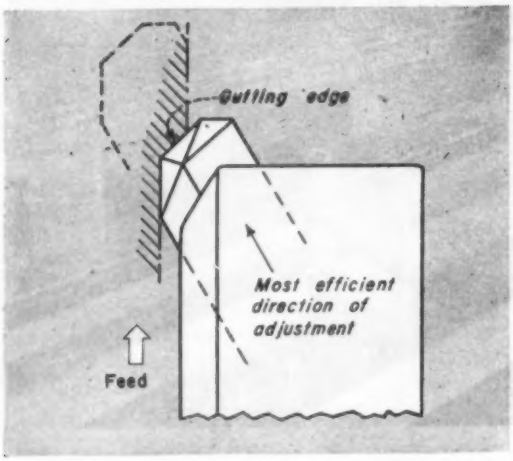
machines, the vertical shaft, which previously was used to support a radial drill head, was inverted and now extends above the carriage to support the radial router arms.

Each router arm carries a 22,000 r.p.m. Onsrud air turbine router-motor so supported that it has a hand-controlled vertical movement of 2⅜ in. A heavy tension spring holds the router motor in its upper position unless hand pressure on the operating arm moves it down into cutting position. Both single-head and double-head routers of this type have been made, the double-head machine permitting the use of two types of cutters without frequent changes of cutting tools. Single flute router bits, 5/16 in. dia., are used in all heads. These bits are flash chrome plated to prevent "welding" of chips on the cutting edge. The chrome plate is stripped each time the bit is resharpened, then replaced before use.

Two sizes of router tables have been developed for this type of routing machine. One is 228 in. long, the other 396 in. long. Table assemblies supporting the router carriages are of welded steel construction braced to prevent deflection when the machine is in use. Each of the support legs is fitted with an adjustable base section so the frame can be leveled on the shop floor. It is important that these frames be kept level and straight, as a twisted frame would lead to inaccurate support of the spar sections which must be machined to close tolerances.

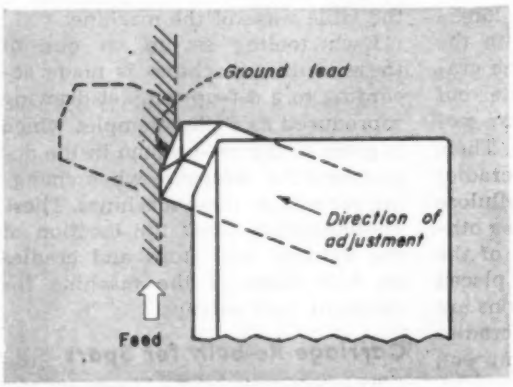
Direction of Adjustment Affects Cutter Efficiency

BY R. R. WEDDELL, WEDDELL TOOLS, INC.



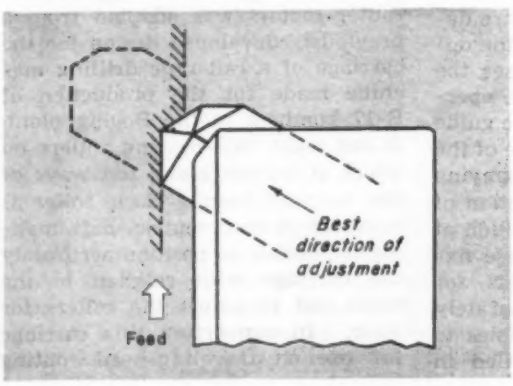
ROUGHING

Cutting is on the peripheral edge of the blade, the face merely scraping the surface already cut. Suitable chamfer increases the strength of the tool corner and directs the cutting thrust towards the spindle bearings



GENERAL PURPOSE

For general purpose milling the blade can be ground straight, with a broad chamfer or with a lead on the face. Flexible blade adjustment is attainable



FINISHING

A lead ground on the face of the blade gives a shearing effect and directs the cutting thrust towards the spindle bearings for improved work finish

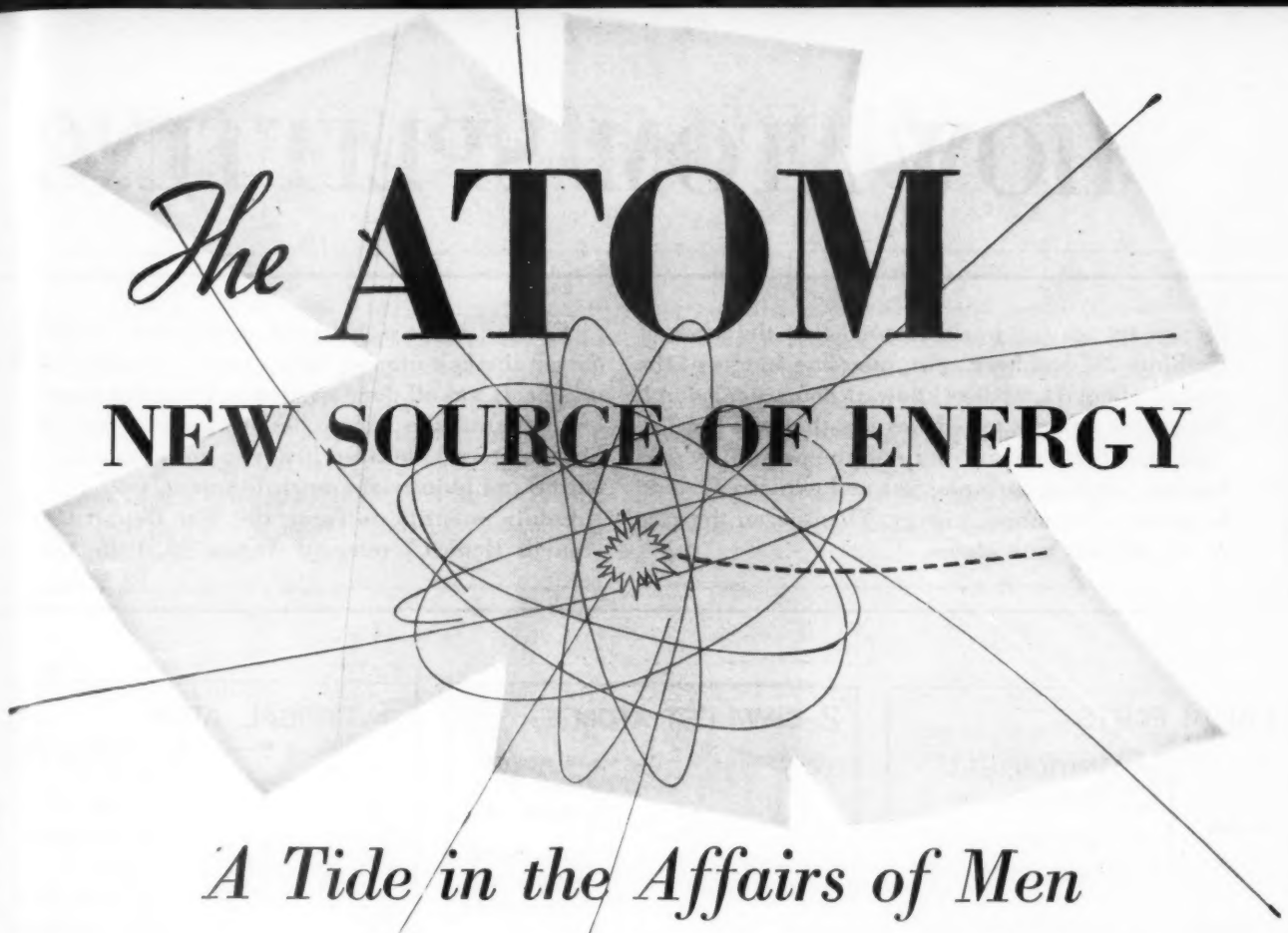
MILLING CUTTER blades generally show maximum wear on the peripheral edge while the face remains comparatively sharp. Consideration of this fact and a modified disposition of the inserted blades in cutters results in maximum life with minimum grinding.

As the cutter feeds along in roughing cuts the peripheral edge of the blade forms a metal chip of appreciable thickness. The variable dimension of the chip is relative to the radial direction of the blade and, regardless of the cutting angles, the chip starts to flow along the peripheral edge. Thus, for roughing cuts, most grinding is necessary on the diameter and not on the face. The blade should be adjusted in a radial direction.

For finishing operations the cutting face of the blade should be ground at a slight angle to lead the cutting edge into the work with a shearing action. This also takes up spindle play and directs the thrust against the spindle bearings, producing a smooth work finish. The blade should be adjusted in an almost completely axial direction.

For general-purpose milling the blades should have a combined radial and axial adjustment. A variable amount of adjustment of blade should be attainable and there should be no fixed increments of adjustment, particularly with cemented-carbide cutters. The blades should be set in slots or holes in a conical direction rather than in straight or radial slots. Chamfers suitable for operating conditions should be incorporated to obtain maximum life between grinds.

The ATOM
NEW SOURCE OF ENERGY



A Tide in the Affairs of Men

On August 6, 1945, an atomic bomb exploded over the Japanese city, Hiroshima.

Its concussion blasted the city, vaporized the fibre of Japan's will to resist, and flashed across the world a light of such glaring intensity that even blind eyes could glimpse the forked road that is presented to humanity's choice and destiny.

It has been a scant fifty years since Pierre and Marie Curie embarked upon their research with the avowed intent of discovering "how the atoms of the universe are put together". Their work contributed radium to the knowledge and use of mankind, but it marked only a way station upon the awesome quest which they announced and which thousands of scientists have since pursued.

Under the compelling stimulus of war, the first major application of the release of atomic force has been in an instrument that raises by an unimaginable dimension our ability to dole out death. We can be devoutly grateful that the scientific leadership of the Allies, and particularly the industrial strength of the United States, brought to us, rather than to our enemies, priority in the development of this dread weapon. But even in its present infant phase, it is clear that ownership of the principle of the atomic bomb carries a trusteeship of terrifying gravity.

We hold in trust a power that is capable of unraveling the very fabric of our civilization. Equally, it may be susceptible of development as a mighty force for human welfare. But we have proved the destructive use, while the constructive applications are still in the realm of speculation.

Clearly the trust is of a magnitude that transcends national jurisdiction. No walls have ever been built high enough to fence in the spread of scientific knowledge, and even if we were resolved to forego the harnessing of atomic power for peace, it is hopeless to think that its application for war can be held for long as the monopoly of one, or a small group of nations.

At one giant stride our scientific and technological development has so far outdistanced our social engineering, that we have no choice but to turn our full powers of creative imagination to control the forces we have unleashed and to bend them to man's use rather than to his destruction.

Since control is not possible without understanding, I have asked several of my editorial colleagues in the McGraw-Hill organization to present on the pages which follow a non-technical but authoritative account of the known facts and implications of atomic power.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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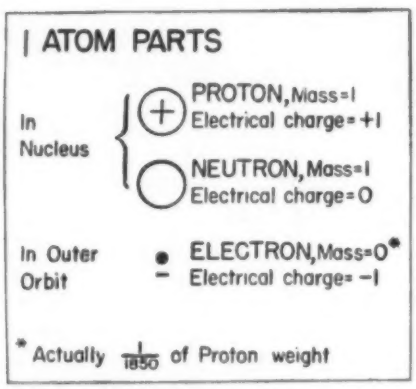
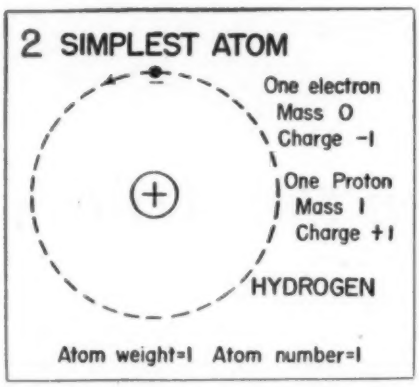
HOW ATOM SPLITTING

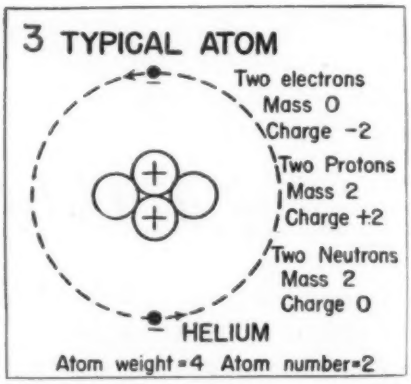
Five years ago the world learned that the atom of Uranium 235 had been split, releasing energy at the rate of about 11,400,000 kilowatt-hours per pound. The whole amount tested was less than the head of a pin, but there was no escaping the possibility that heaters, engines, turbines, jets and explosives could be powered by atomic energy. Then began the race to win the war with atoms.

With what help England could give, America outran the best atom-splitting team Germany could muster. It was all done in silence. From the summer of 1940 until the atomic bomb blasted Hiroshima, black secrecy blanketed history's most amazing scientific and industrial accomplishment.

Coldly scientific in form, the War Department's "Smyth Report," released August 12, 1945, traces

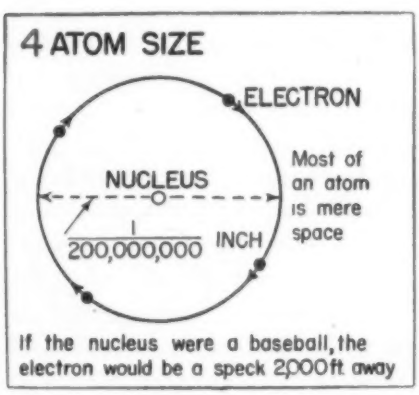


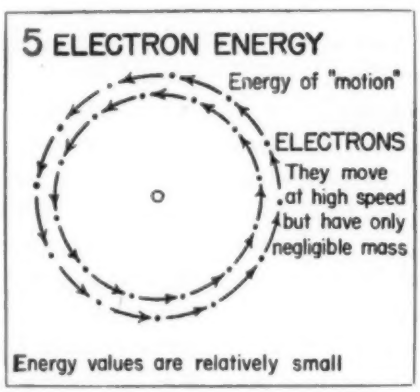


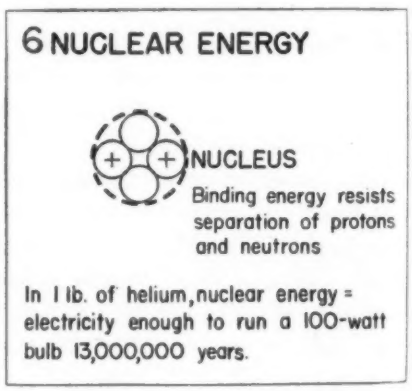


Each of the 92 elements has its own *atom*, yet all atoms are made from the same three pieces, Fig. 1: *proton* (weight 1, electric charge +1), *neutron* (weight 1, charge 0), *electron* (weight 0, charge −1).

Every atom is a tiny "solar system." Its central "sun" has one or more protons, generally neutrons too. The revolving "planets" are electrons, one for each proton in nucleus, because plus and minus must balance in the atom. The opposite charges attract, but high speed keeps the electrons out in their circular orbits, just as the centrifugal tendency of the revolving earth defies the sun's gravitational pull. All the weight of an atom is in the nucleus, so add the number of protons and neutrons to get the atom's weight. The *atomic number* is equal to the number of protons. The elements are known by their atomic numbers. Thus uranium (92 protons) is element 92.


4 ATOM SIZE
ELECTRON
NUCLEUS
1/200,000,000 INCH
Most of an atom is mere space
If the nucleus were a baseball, the electron would be a speck 2000 ft away


5 ELECTRON ENERGY
Energy of "motion"
ELECTRONS
They move at high speed but have only negligible mass
Energy values are relatively small


6 NUCLEAR ENERGY
NUCLEUS
Binding energy resists separation of protons and neutrons
In 1 lb. of helium, nuclear energy = electricity enough to run a 100-watt bulb 13,000,000 years.

With only their outermost orbits touching, it would take half a million atoms to span the thickness of a human hair. Yet if one could expand an atom until its outer orbits encircled 100 acres, the nucleus would be no bigger than a baseball. The atom is mostly empty space, Fig. 4, and nuclei are difficult targets; so much so that a neutron bullet fired at a mass of atoms may pass right through without a hit.

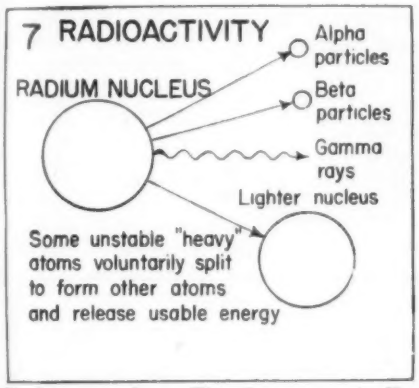
The almost weightless speeding electrons, Fig. 5, supply all the energy of chemical reactions (as when coal burns or TNT explodes). Evading all ordinary chemical action, the immensely greater energy bound up in the nucleus, Fig. 6, can be released only by direct hits on the nucleus to break the bonds that hold the protons and neutrons in a tight bundle.

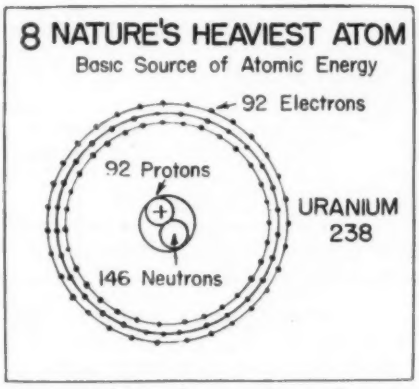
RELEASES ENERGY

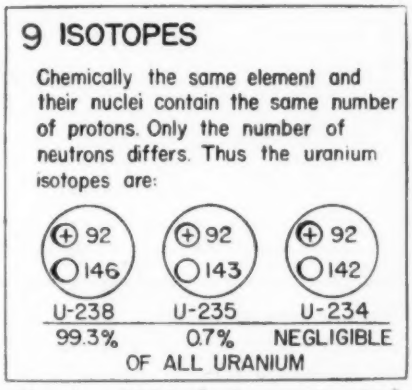
the fantastic course of atomic engineering through the five years of news blackout. It leaves no doubt that only a complete mobilization of America's technical resources could have won this victory in time.

Other writers in other places will unfold the epic story. This presentation leaves no space to reflect the glory of the accomplishment or even to record its history. The aim is more immediately practical — to give the professional and business readers of the McGraw-Hill publications a sound and honest, though non-technical, understanding of this atom-smashing business, so that they will know better what to do about it in their personal and business lives.

Now for step one: learning the shape of atoms and how atom splitting releases energy.

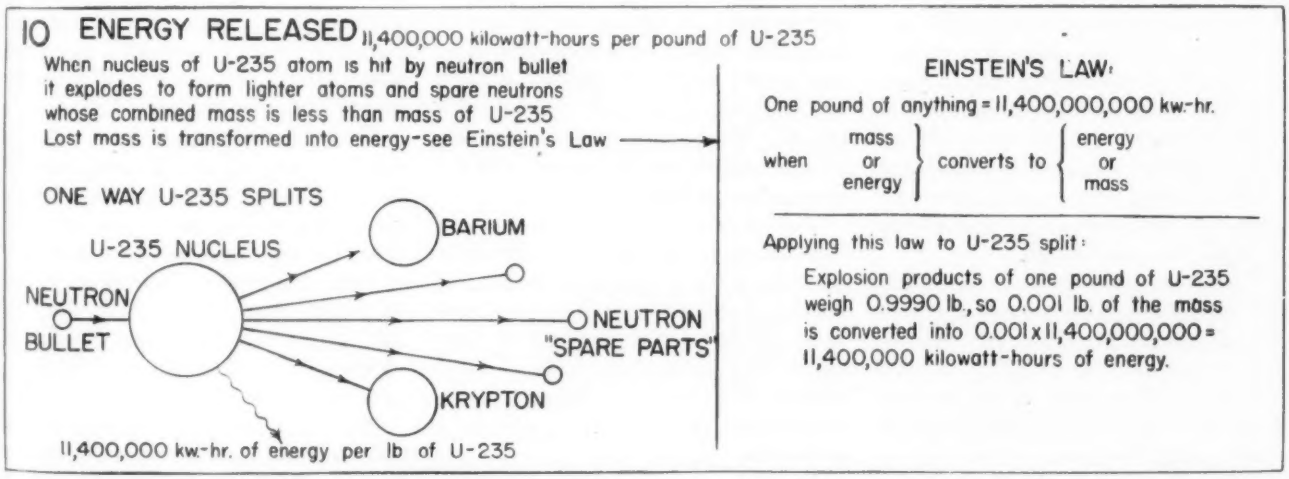






Radium nucleus, Fig. 7, automatically emits particles and energy as it decays to form nuclei of a lighter atom. Most common form of uranium, nature's heaviest atom, is Uranium 238, Fig. 8. This form is not directly useful for energy release, but is important as the raw material for a new synthetic power atom, *plutonium*.

An element may have several *isotopes* — alternate forms with the same number of protons but slightly different numbers of neutrons. Uranium 238 is the isotope in which protons and neutrons total 238 (so atom weight is 238). It is 99.3% of the total weight of pure, natural uranium. The stuff needed for direct atomic-energy release is Uranium 235, only 0.7% of the total weight and very difficult to separate from 238. To put it another way, every pound of energy-giving U-235 comes mixed with a dead load of 140 pounds of relatively inert U-238.


10 ENERGY RELEASED 11,400,000 kilowatt-hours per pound of U-235
When nucleus of U-235 atom is hit by neutron bullet it explodes to form lighter atoms and spare neutrons whose combined mass is less than mass of U-235 Lost mass is transformed into energy-see Einstein's Law
ONE WAY U-235 SPLITS
U-235 NUCLEUS
NEUTRON BULLET
BARIUM
NEUTRON "SPARE PARTS"
KRYPTON
11,400,000 kw.-hr. of energy per lb of U-235
EINSTEIN'S LAW:
One pound of anything = 11,400,000,000 kw.-hr.
when mass or energy converts to energy or mass
Applying this law to U-235 split:
Explosion products of one pound of U-235 weigh 0.9990 lb., so 0.001 lb. of the mass is converted into 0.001 x 11,400,000,000 = 11,400,000 kilowatt-hours of energy.

Slow neutron bullet splits Uranium 235 nuclear target, generating two lighter atoms (Fig. 10 shows one possibility) and several free neutrons ready to split other U-235 atoms. The following pages show how the original neutron may be produced and directed and how a chain of self-propagating atomic explosions may sweep through a block of U-235 like a forest fire to release heat energy equivalent to 11,400,000 kilowatt-hours per pound.

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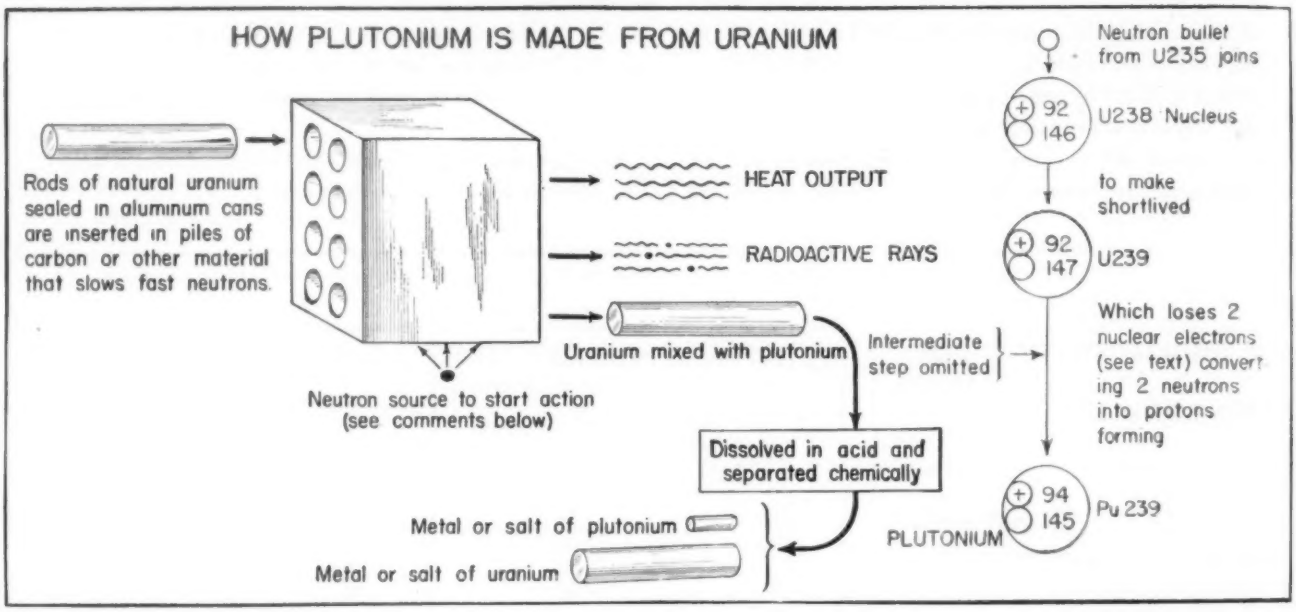
CREATING and ISOLATING

Man-Made Plutonium—U-235 Substitute


HOW PLUTONIUM IS MADE FROM URANIUM
Rods of natural uranium sealed in aluminum cans are inserted in piles of carbon or other material that slows fast neutrons.
HEAT OUTPUT
RADIOACTIVE RAYS
Uranium mixed with plutonium
Neutron source to start action (see comments below)
Intermediate step omitted
Dissolved in acid and separated chemically
Metal or salt of plutonium
Metal or salt of uranium
Neutron bullet from U235 joins
92 146 U238 Nucleus
to make shortlived
92 147 U239
Which loses 2 nuclear electrons (see text) converting 2 neutrons into protons forming
94 145 Pu 239
PLUTONIUM

We now have two kinds of atoms suitable for energy supply, Uranium 235 and the new man-made element No. 94, plutonium. Uranium, No. 92, has the heaviest atom of any natural element.

The Manhattan Project's plant, on the Columbia River at Hanford, Washington, is the world's greatest atom-making factory. Devoted entirely to the mass production of plutonium atoms, it uses U-238 as the raw material and U-235 as the energy source, intimately mixed in the same proportions as in natural uranium metal.

The production units at Hanford are several huge uranium "piles." Each is a very large block of graphite with holes in which are placed uranium-metal cylinders, sealed in aluminum cans to protect the uranium from corrosion by the cooling water constantly pumped through the pile.

Each pile runs itself, so to speak. Not even the conventionally pictured bits of radium, beryllium and paraffin are needed as a "pilot light" to start operation. There are always enough stray neutrons, or even cosmic rays, to start a chain reaction.

But once started, the design, size and control of the unit must be such that the chain reaction will continue at an even rate — neither die down nor overshoot into an explosion.

To see this picture in atomic terms, consider the fraction of a second in which one million U-235 nuclei are split, producing two million lighter atoms (say, one million of barium and one million of krypton) and between one and three million fast-moving neutron projectiles.

Some of these escape in free flight right through the relatively vast atomic "open spaces." Some are "captured" by the many U-238 nuclei, and others are captured by the impurities. But, on the average, of the one to three million, just one million neutrons must succeed in smashing another million U-235 atoms in the next fraction of a second. Thus, with reproduction rate exactly maintained, life goes on in the atomic-energy pile.

The carbon, one of several possible "moderators," serves to slow down the neutrons without capturing many. The chance of a fast, straight-moving neutron hitting a tiny nucleus is very small, whereas the "slow ball" neutron is likely to be sucked in by the nuclear attraction if it would otherwise be a near miss.

From the practical angle, maintaining a chain reaction requires careful design and good controls. The pile must be slightly larger than actually necessary for a chain reaction (that means scores of tons of material). Controls must be sensitive and dependable. They slow the pile down to the balancing point by sliding in retarders, such as strips of cadmium.

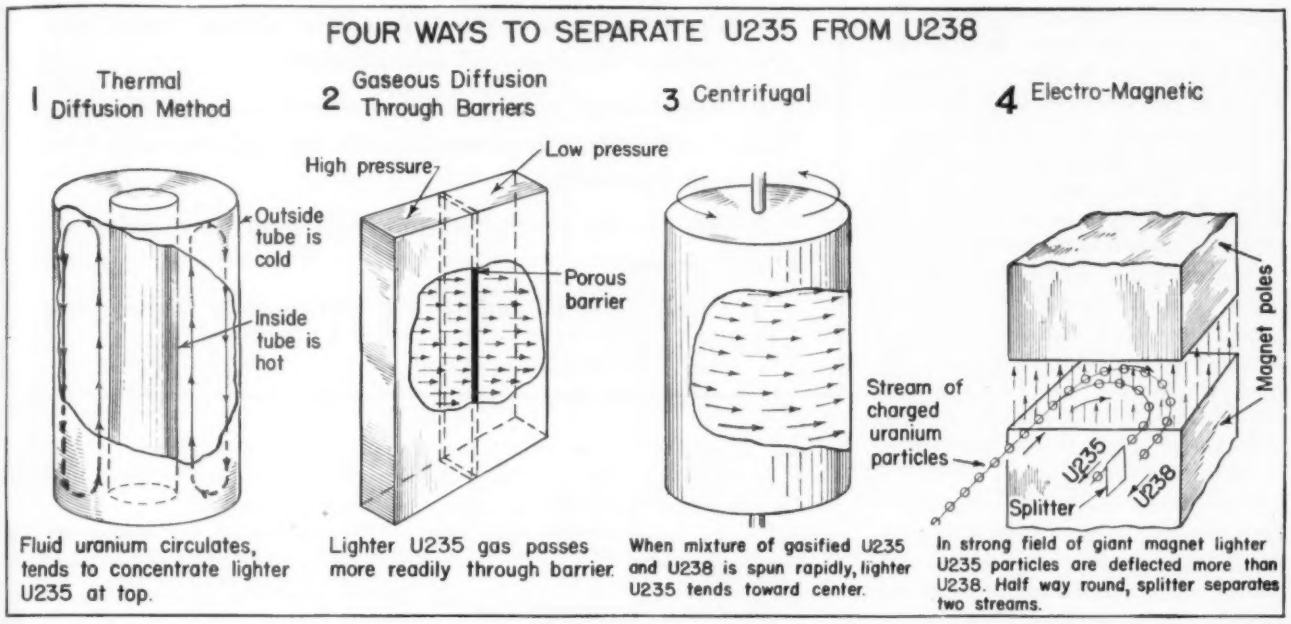
As already noted elsewhere, the energy released is about 11,400,000 kilowatt-hours for each pound of U-235 split. This energy appears first in the high speed of the pieces thrown off by the atomic split, then is converted to sensible heat as collisions slow down these projectiles. The energy is finally removed from the pile in the form of hot air, steam, hot water or other heated fluid in commercial quantity and thermal condition.

Such piles, operated with normal uranium, or with uranium enriched in U-235, would seem to be the primary means by which atomic energy will serve (if ever) as a commercial source of heat and power. Plutonium would be a byproduct, but might under certain conditions add to the energy yield of the pile without the need to separate it from the uranium.

The use of normal uranium in the Hanford pile sounds extremely attractive as a heat source, but has certain economic disabilities. Only a small part of the U-235 is used up before the pile must be shut down to remove the plutonium.

THE HIGH-POWER ATOMS

Isolating U-235 — a Gigantic Task


FOUR WAYS TO SEPARATE U235 FROM U238
1 Thermal Diffusion Method
2 Gaseous Diffusion Through Barriers
3 Centrifugal
4 Electro-Magnetic
Outside tube is cold
Inside tube is hot
High pressure
Low pressure
Porous barrier
Stream of charged uranium particles
Magnet poles
U235
U238
Splitter
Fluid uranium circulates, tends to concentrate lighter U235 at top.
Lighter U235 gas passes more readily through barrier.
When mixture of gasified U235 and U238 is spun rapidly, lighter U235 tends toward center.
In strong field of giant magnet lighter U235 particles are deflected more than U238. Half way round, splitter separates two streams.

Many of the uranium ores, including most samples of pitchblende and carnotite, will yield from 1 to 15% metallic uranium. Chemical separation of the metallic "natural" uranium is simple. Whatever the source, natural uranium contains the three isotopes in the constant proportions of 99.3% U-238 and 0.7% U-235, with traces of U-234.

Separating the U-235 from U-238, an operation essential for explosive uses of U-235, and probably important for future commercial controlled-chain piles, has been most difficult. Chemical separation was impossible because U-235 and U-238 are chemically the same.

The only possibility was a separation by physical differences, primarily a one percent difference in weight. The porous barrier and centrifugal methods pictured above required vaporizing a salt of uranium. All the methods shown have been used or tried on the Manhattan Project. All require many stages to achieve a substantial concentration of Uranium 235.

Dollarwise Thoughts on Atomic Energy

Costs mean little in war, but peacetime uses of U-235 and plutonium must pass the dollar test in competition with coal, fuel oil, natural gas, gasoline and electricity.

On the basis of energy costs only, "*all other things being equal*," the table on the last page of this section shows at what price per pound U-235 would give the same energy cost as conventional energy sources selling at the indicated prices. For such comparisons it is convenient to remember that one pound of U-235 is equal (energy-wise) to about 11,400,000 kilowatt-hours, also to 1500 tons of coal, or 200,000 gallons of gasoline.

Fuel engineers understand the limitations of such oversimplified comparisons. Others should be warned that "all other things" are never equal. With this thought in mind, reconsider the uranium piles operated at Hanford to produce plutonium. These use U-235 in the cheapest form, say about $1400 per lb., assuming purified normal uranium at $10 per lb. (140 lb. of uranium contains one pound of U-235.)

If this were the whole story, coal would have to sell for a dollar a ton to break even with U-235 as a water heater. However, the pile using normal uranium must be immense to hold its own in a chain reaction. More important, the accumulating fission products "poison" the reaction after only a small part of the U-235 has been used up. Then the uranium cylinders must be removed for plutonium recovery. Finally, it has not yet been found possible to operate the normal-uranium piles at high enough temperatures for practical power production.

If we go to the other extreme and build a small pile, using concentrated U-235, we shall run into excessive material costs, perhaps several times the $52,000 per lb. set down in the table as the equivalent of 20-cent gasoline.

Something between the two extremes is likely to prove the most economical — perhaps a pile operating on a U-235 concentration between 1 and 10%.

The engineer of the "atomic-power age" must know the price of Uranium 235 *in various concentrations* and the characteristics of piles suited to them. No such information is yet available. He must also watch the danger from radio-activity; the requirements for radiation shields; explosion hazards, etc.

CONTINUED ON NEXT PAGE

WHAT TO EXPECT

Before discussion of possible and probable future applications of atomic energy to the arts of peace, the atomic bombs should have consideration. We may assume that these bombs contained from two to 200 lb. of either U-235 or plutonium, or both. No more precise information is available.

Details of the bomb design have been completely suppressed, but the following basic considerations are stated or implied in the Smyth Report:

The explosive in a bomb must be highly concentrated U-235 or plutonium. Since slow neutrons could not produce a satisfactory explosion, the neutron retarder or *moderator*, is minimized. This, in turn, requires a U-235 mass so large that the escape of neutrons without hitting nuclei will not be excessive. For every 1000 atoms hit, the neutrons produced must split more than 1000 new atoms, so that the reaction will proceed rapidly in an expanding chain, as sketched below.

There can be little leeway in the size of the explosive charge. For a given shape there is a certain "critical" weight of material. If this is exceeded the bomb explodes instantly. If the weight of charge is less than the critical, it cannot be made to explode.

Therefore, the critical mass must be created at the moment of explosion.

The Smyth Report suggests that this can be accomplished by breaking down the charge into two or more well-separated parts, each having less than the critical mass. At the appointed moment these could be brought together within the bomb to create a supercritical mass, which would then explode automatically.

CLAIMS LIKE THESE ARE NOT JUSTIFIED

1. Pretty soon no more coal will be mined except as a raw material for chemical manufacture.

2. In a few years a tiny bit of uranium, built in at the factory, will drive your car for life through an engine no bigger than your fist.

3. All the big central stations will soon be running on atomic power.

4. Cheap atomic energy will enormously reduce the price of power.

Peacetime Applications

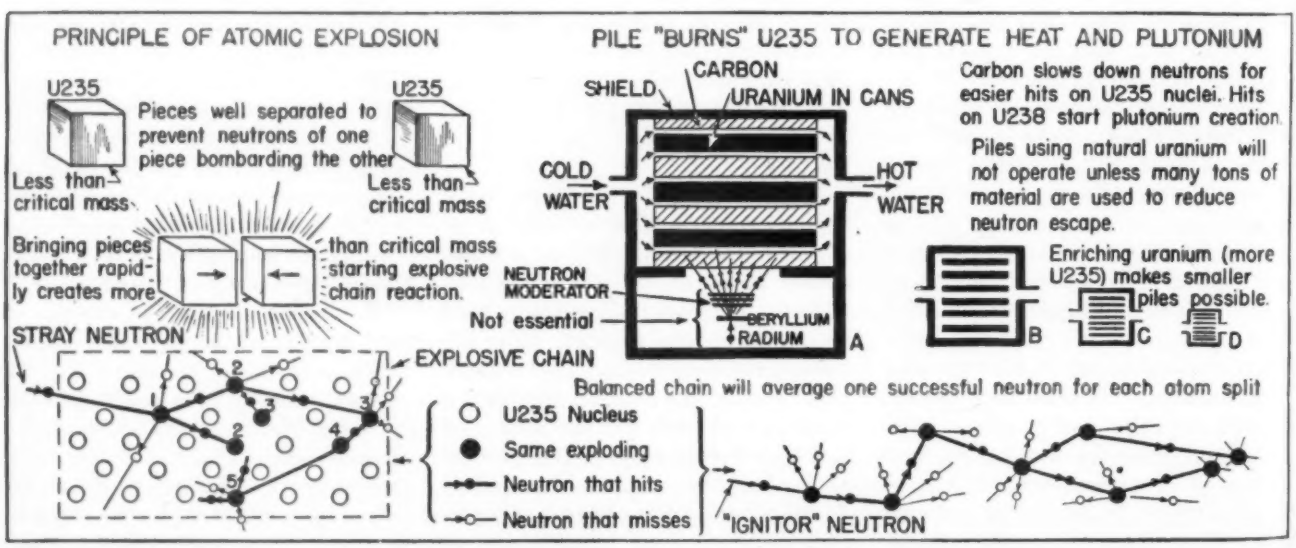
Except possibly for superblasting operations, uncontrolled explosive reactions cannot be permitted in the peacetime use of atomic energy. This means that the quantity of U-235 assembled in any one spot must always be kept well below the critical weight to avoid spontaneous explosion.

Depending on the particular application, the most desirable concentration of U-235 may range anywhere from the 0.7% in normal uranium up to 100%, with the probability that many industrial applications will find the greatest economy in concentrations between 1% and 15%.

This matter of the degree of concentration of U-235 has received little public attention, yet nothing could be of greater practical importance. To make this point clear, consider the two extremes, 0.7% of U-235 and 100% of U-235, respectively.

The Hanford pile, using normal uranium (0.7% U-235) with carbon moderator, must be very large to work at all. It is inefficient in the sense that it must be shut down after a small part of the U-235 has been consumed. It cannot operate at high temperatures.

Its great advantage as a heat producer is the fact that its U-235 is bought at the lowest possible price. If


PRINCIPLE OF ATOMIC EXPLOSION
U235
U235
Pieces well separated to prevent neutrons of one piece bombarding the other
Less than critical mass
Less than critical mass
Bringing pieces together rapidly creates more than critical mass starting explosive chain reaction.
STRAY NEUTRON
EXPLOSIVE CHAIN
PILE "BURNS" U235 TO GENERATE HEAT AND PLUTONIUM
CARBON
SHIELD
URANIUM IN CANS
COLD WATER
HOT WATER
NEUTRON MODERATOR
Not essential
BERYLLIUM
RADIUM
A
Carbon slows down neutrons for easier hits on U235 nuclei. Hits on U238 start plutonium creation.
Piles using natural uranium will not operate unless many tons of material are used to reduce neutron escape.
Enriching uranium (more U235) makes smaller piles possible.
B
C
D
Balanced chain will average one successful neutron for each atom split
U235 Nucleus
Same exploding
Neutron that hits
Neutron that misses
"IGNITOR" NEUTRON

FROM ATOMIC ENERGY

. . . BUT REMEMBER THESE FACTS

1. The large-scale, controlled release of heat energy from U-235 has been fully demonstrated.

2. Beyond question, this energy could be applied directly for heating water and air, and making steam.

3. Such heat, in turn, could be applied directly, or converted into mechanical power or electricity by conventional steam turbines and gas turbines.

4. If and when U-235 in concentrations up to 10% costs less than $25,000 per lb., it may find applications, but will compete, at first, with premium fuels rather than coal.

purified normal uranium sells for, say, $10.00 per lb., the price of 140 lb. (containing one lb. of U-235) will be only $1400. This would be a very favorable price if the pile could operate efficiently with the 0.7% U-235.

Concentrating the U-235 to 100% would permit a much more compact and convenient pile — perhaps little more than small pieces of U-235, encased in aluminum to ward off corrosion, and immersed in a tank of water; this should convert the water into steam at a regulated rate.

In large part, the control would be inherent. The water as a moderator would keep the chain going, but if the reaction got too violent, the resulting higher superheating of the steam would decrease the moderator effect and thereby hold the reaction in check. Yet even if all this comes true the cost of concentrated U-235 in the near future will be many times $10,000 per lb.

Running up the concentration only a few percent above that in normal uranium may prove to be the way to get reasonable pile size and good efficiency without incurring exorbitant concentration costs.

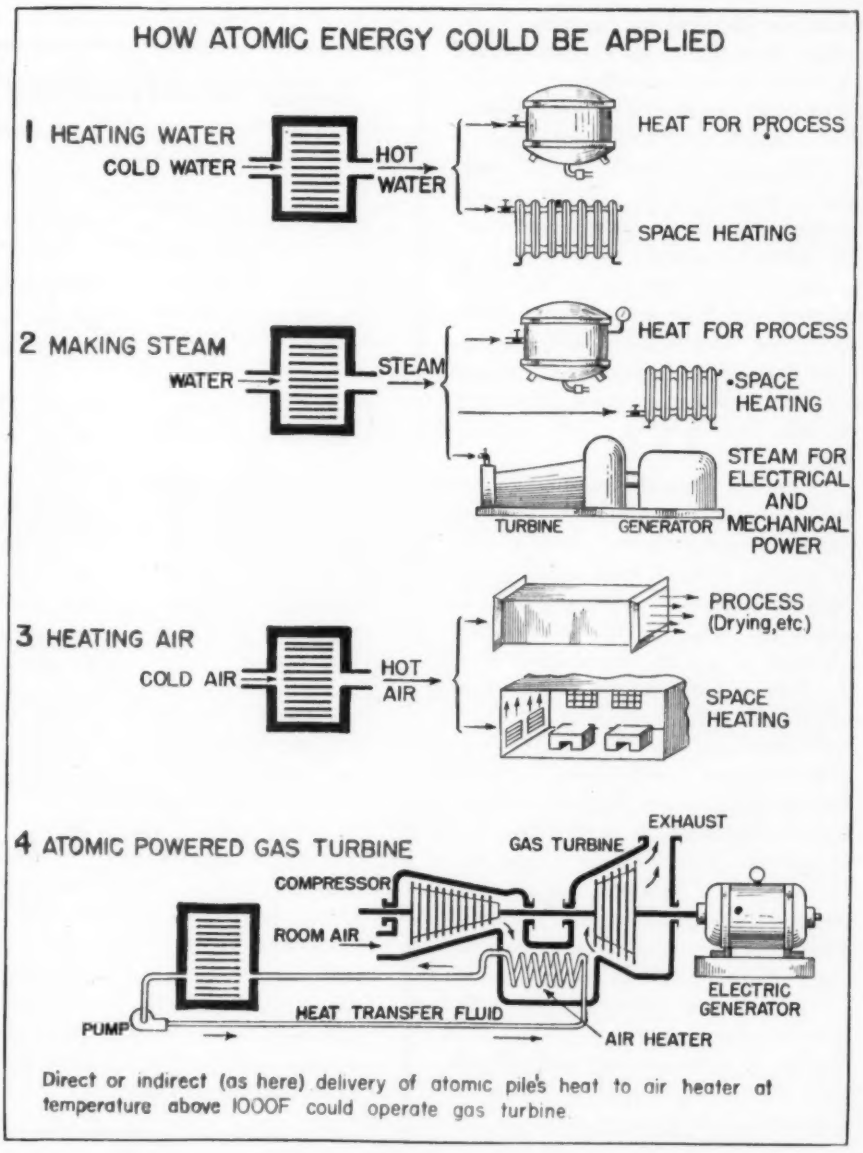
When atomic energy is applied, the starting point is heat, picked up by water, air or a special heat-transfer fluid. Intermediate heat transfer fluids may be essential in certain applications (space heating and service water, for example) where people must be protected from injury by radioactivity.

The intermediate heat-transfer fluid shown for the gas turbine would, of course, have to operate at temperatures up to 1200 F. There seems to be no basic reason why the pile itself could not be built inside the compressed-air receiver, discharging its heat directly to the compressed air.

With rather high concentration of U-235, this arrangement might be suitable for large airplane drive if excessive weight of radiation shields could be avoided.

Also, presumably, rockets and planes of the "buzzbomb" type could be powered by atomic heat delivered to the air of the jet steadily, not in puffs.

The sketches stress direct applica-



Direct or indirect (as here) delivery of atomic pile's heat to air heater at temperature above 1000F could operate gas turbine

THESE THINGS MIGHT RESTRICT USE OF ATOMIC ENERGY

1. Ineffectiveness of large piles using normal U-235 concentration
2. High cost of concentrated U-235 for smaller, more effective piles
3. Danger from radioactivity
4. Weight and cost of shielding against radiation
5. Explosion hazard
6. Possible short supply of uranium
7. Governmental restrictions on atomic-energy materials

tions of hot air, steam and hot water to process and space heating. This emphasis is justified by the often overlooked fact that such applications of heat have many times the total energy value of all the electricity generated in the United States for all purposes.

There has been much popular speculation regarding the type of engines required for atomic-power generation. The answer is simple. Present engines, steam turbines and gas turbines can be used with little or no change. This, of course, does not rule out the possible discovery of specialized engines for atomic power, or even direct production of electricity from atomic energy.

In the long run the implications of atomic power are staggering for both war and peace. However, popular writers on the subject have undoubtedly created unreasonable hopes in the minds of readers — for example, the expectation that in two or three years the Detroit builders will market cars with built-in "lifetime" slugs of U-235 and "fist-sized" engines.

Yet it seems fairly safe to predict that atomic energy will find some commercial applications within the next five or ten years, first, probably, as a premium fuel like aviation gasoline, worth a fancy price for specialized applications where low weight or some other characteristic is important.

As the cost of concentrating U-235 is reduced and application efficiencies improved, atomic energy may compete with cheaper fuels, perhaps ultimately with coal.

Important non-power applications of atomic energy may well include the ultra-high-temperature processing and fabricating of materials — also, modern "alchemy": building and rebuilding atoms to create new elements and to produce old elements at lower costs.

Radioactivity obtained directly or indirectly from artificial atom-splitting should find many important medical and industrial applications.

Turning back to ordinary power applications, we must avoid the temptation to overstress the economic importance of lower-cost power fuel. Fuel cost is only about 17% of the gross receipts of the electric utilities. Here's another way to put it: If, after allowing for transmission losses, one kilowatt-hour delivered to the consumer from modern plants represents a coal consumption of 1.5 lb., and if the coal costs $5.00 per ton cancellation of the coal bill could not save more than ⅜ of a cent per killowatt-hour. And atomic fuel will certainly not be free.

Performance of the atomic bomb is a monument to the scientists who unlocked the secrets of the atom and suggested the basic technique of making plutonium and concentrating U-235.

From there on, the job was at least 50% engineering. The various big plants of the Manhattan Project are vast assemblages of pipes, tanks, boilers, valves, instruments and controls, installed and operated by engineers, largely designed by engineers. From now on, the speed with which atomic power becomes practical will depend on the effectiveness of the engineer-scientist team.

It is possible, of course, that national controls may completely upset the entire technical and economic pattern of this discussion. For reasons of national security the government may decide to control or restrict atomic-power materials, plants and operations in ways not yet determined.

U-235 COULD COMPETE AT THESE PRICES

other things being equal

Common fuel	*Assumed prices*	*Comparable prices for Uranium 235, dollars per pound (nearest thousand)*
COAL (13,000 B.t.u.)	$6 per ton	$9,000
	$12 per ton	$18,000
	$15 per ton	$23,000
FUEL OIL (150,000 B.t.u. gal.)	2¢ per gal.	$5,000
	4¢ per gal.	$10,000
	8¢ per gal.	$20,000
CITY GAS (500 B.t.u.)	50¢ per 1000 cu. ft.	$39,000
	$1 per 1000 cu. ft.	$78,000
NATURAL GAS (1000 B.t.u.)	25¢ per 1000 cu. ft.	$10,000
	50¢ per 1000 cu. ft.	$20,000
	$1 per 1000 cu. ft.	$40,000
GASOLINE (150,000 B.t.u. gal.)	10¢ per gal.	$26,000
	20¢ per gal.	$52,000
	30¢ per gal.	$78,000

BUT

Note that "other things" are never equal. U-235 in normal uranium form is by far the cheapest, but involves use of excessively large and inefficient "piles." The unit cost of the U-235 in enriched mixtures increases with the degree of enrichment. Over-all cost comparisons can be made only for a specified concentration of U-235 and for apparatus suitable for that particular concentration. Possible explosion danger and need to protect personnel against radiation are other important considerations.

Magnetic Core Laminations Produced at Minimum Cost

BY GUY M. SHINGLEDECKER, LAMINATIONS DIVISION, ALLEGHANY LUDLUM STEEL CORPORATION

Good selection of steel, use of progressive dies of sectional type and a closely controlled annealing procedure are essential in fabricating magnetic core laminations on a sound basis

HIGHLY ESSENTIAL to the 40,000,000 odd electric motor horsepower feeding America's industries is the fabrication of magnetic core laminations. Technological development in this field has been steady and some of the factors contributing to this development have been:

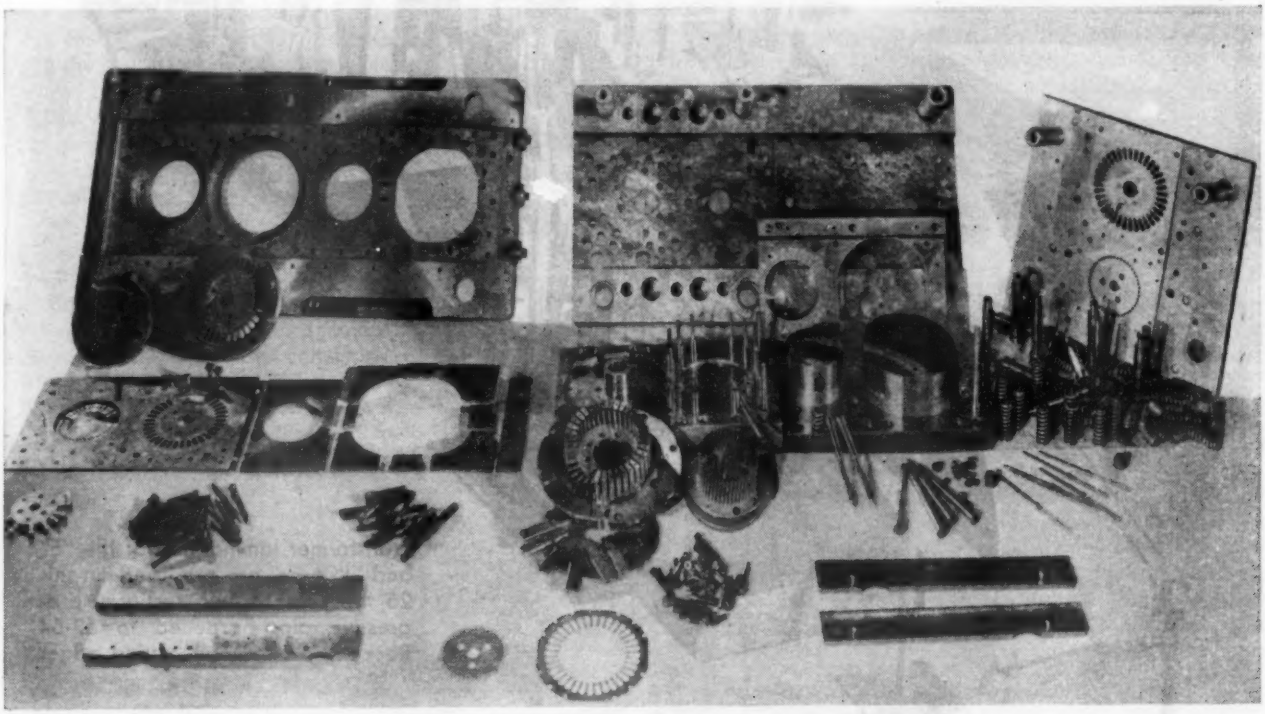
1. Creation of new raw materials
2. Improvement in tool steels
3. More efficient melting and rolling of electrical sheet and coil
4. Specialized die-making to meet requirements of stamping and punching operations
5. Increased speed, precision and durability of press equipment
6. Advanced inspection and testing practice

The successful, competitive manufacture of laminations calls for the rapid production of great quantities of more than 30,000 different gages, grades and types of small parts on which unit profit is low. In spite of this all laminations must conform to rigid standards of magnetic performance and dimensional accuracy, making minimum scrap loss mandatory.

In seeking the ideal production of laminations, the right steel with the correct electrical characteristics and stamping qualities is an essential starting point. Another essential is the correct annealing of the laminations after stamping for desired electrical characteristics and utilization of the lowest cost steel. The state of compression into which the laminations are placed in the finished equipment, as well as the final state of the oxide insulating coating on the laminations, are added variable factors.

Although electrical steels are available in sheets and coiled stock the latter usually has better characteristics, particularly when the path of the magnetic flux in the finished laminations is in the direction of rolling. This makes it ideal for wound cores, but at a disadvantage in laminations where a large part of the path of the flux is across the direction of rolling. Laminations made from coiled stock have a better stacking factor.

Selection of good tool steel and proper die design are two of the most necessary steps for ideal lamination production. Since minimum burr height as well as dimensional accuracy is essential, great care must be used in determining clearances



Typical lamination dies, partly dissembled, with hundreds of the precision ground parts

between punches and dies. A slight variation in thickness or hardness of material can make material workable or unworkable with a given die clearance. An accuracy of plus or minus .0001 in. should be maintained on most types of dies.

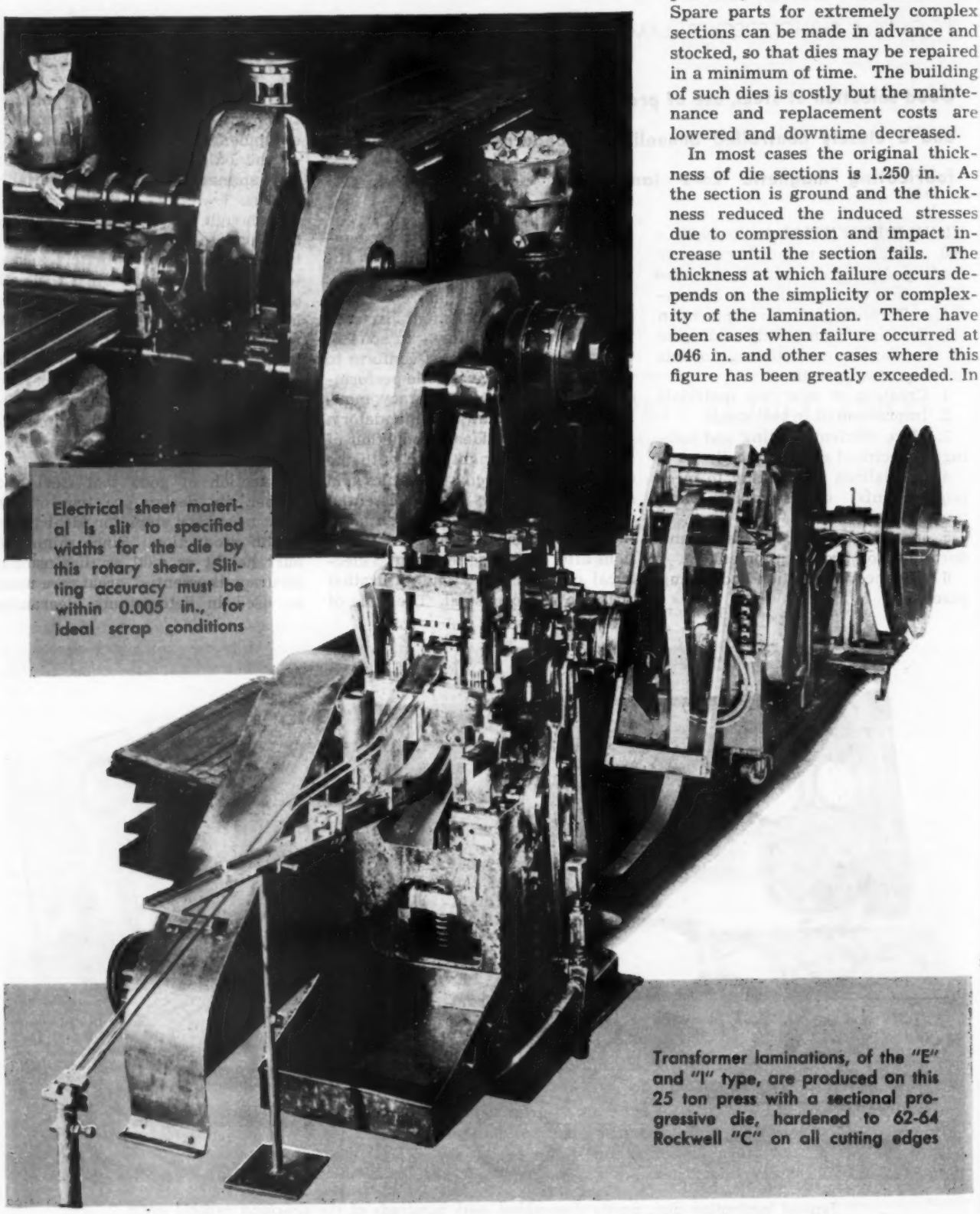
To obtain the lowest die cost per pound of finished laminations, it has been found desirable to follow recommended punch clearances and to maintain the following burr inspection limits in die grinding practice:

Gage	*Burr Limit*
No. 29	0.002 in.
No. 26	0.0025 in.
No. 24	0.003 in.
No. 22	0.0035 in.

The substantial loss encountered in the breaking of a solid die has been responsible for the present practice of using built-up dies. The complex geometry of some of the fabricated parts makes it necessary to build the dies in sections to facilitate grinding.

Now, any breakage may be repaired by insertion of a new section. Spare parts for extremely complex sections can be made in advance and stocked, so that dies may be repaired in a minimum of time. The building of such dies is costly but the maintenance and replacement costs are lowered and downtime decreased.

In most cases the original thickness of die sections is 1.250 in. As the section is ground and the thickness reduced the induced stresses due to compression and impact increase until the section fails. The thickness at which failure occurs depends on the simplicity or complexity of the lamination. There have been cases when failure occurred at .046 in. and other cases where this figure has been greatly exceeded. In



Electrical sheet material is slit to specified widths for the die by this rotary shear. Slitting accuracy must be within 0.005 in., for ideal scrap conditions

Transformer laminations, of the "E" and "I" type, are produced on this 25 ton press with a sectional progressive die, hardened to 62-64 Rockwell "C" on all cutting edges

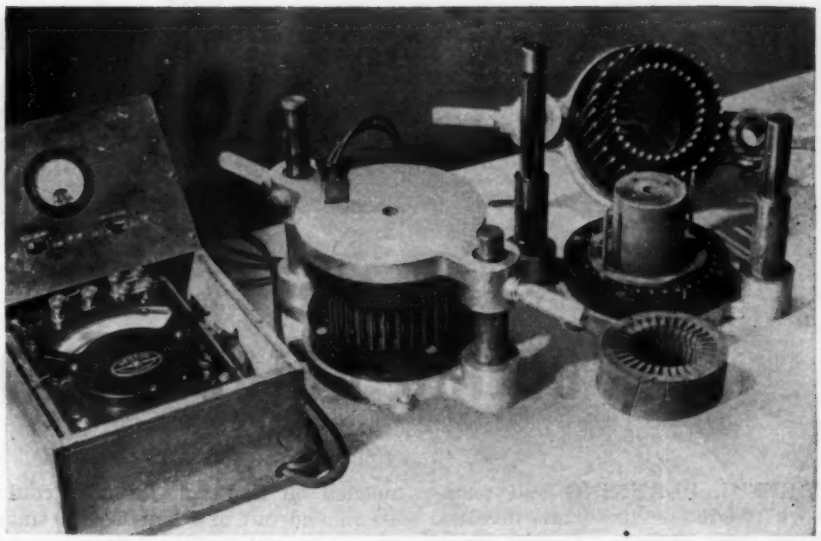
some cases the die did not fail but was ground down so thin that the threads in the screw holes would not hold the die plate in the shoe.

The production of built-up dies requires a tool department with the finest equipment and with tool makers trained to work to extremely close tolerances. The reaction in the Alleghany Ludlum die shop is to buy the best equipment available and in most cases rebuild the machine before putting it into operation. This rebuilding involves painstaking hand scraping of ways and special fitting of all bearings to a degree necessary to turn out work with tolerances of plus or minus 0.0001 in. Most of the grinding machines are provided with magnetic chucks, and magnetic jigs are used for positioning parts which must be ground to special angles.

Since the best die, punching a steel with ideal stamping qualities, can be ruined on a defective press special attention is given to this equipment. When a new press is bought for the Alleghany Ludlum shop it is usually torn down and rebuilt before being placed in operation. Wearing parts are chromium plated to minimize wear and all bearings are refitted to insure accuracy and long life. A continuing program of inspection and maintenance is followed on all press equipment.

Progressive dies, of from three to five stations, are used for most jobs and particularly where such operations as piercing, slotting and blanking are performed in sequence. In the case of a typical rotor and stator die the sequence is as follows: pierce rotor, blank rotor, trim air gap, slot stator and blank stator. This type of die produces laminations suitable for automatic stacking and perfect alignment as they flow from the press, and saves time and labor as compared with the compound method.

An interesting operation is the production of "no scrap" transformer laminations, usually consisting of "E" and "I" shapes. They are designed to secure both maximum material economy and electrical performance. The only loss in the material is due to the holes and the best electrical performance is obtained by having most of the section in the direction of rolling.



Alleghany Ludlum developed this apparatus for measuring core loss and exciting current, in testing stator laminations

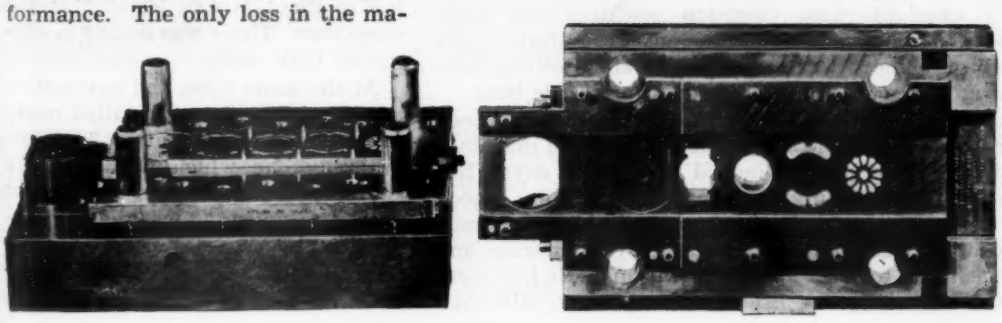
The holes are punched from the strip at the first station. The "I" pieces are then blanked out, forming the windows of the "E" pieces. The "E" pieces are then blanked and two "E" and "I" pieces are formed with each stroke of the press. Here, economy in material is gained by making the "I" pieces twice as long as the "E" windows.

After punching, the laminations are inspected, stacked and wired together in preparation for annealing. Most types of steel are annealed in electric furnaces, under controlled atmosphere and with high grade recording equipment. The annealing of high permeability nickel alloys is conducted under dry hydrogen at high temperature. A suitable inert material is used between the laminations to keep them from fusing together. Annealing of this type of steel is a complex and specialized process and requires proper equipment and actual experience.

Extensive facilities are required for testing stacks of lamination in order to determine the performance of the electrical apparatus for which the stack is intended. In making tests, the laminations are assembled into finished cores and are placed in windings similar to those used in the final assembly, reproducing conditions under actual use.

RECOMMENDED PUNCH CLEARANCES

GRADE OF STEEL	NO. 29 GAGE	NO. 26 GAGE	NO. 24 GAGE	NO. 22 GAGE
Transformer	0.0007 in.	0.00085 in.	0.001 in.	....
Dynamo Special	0.0007 in.	0.00085 in.	0.001 in.	....
Dynamo	0.0006 in.	0.00075 in.	0.0009 in.	....
Electrical	0.0005 in.	0.00075 in.	0.0009 in.	0.0015 in.
Armature	0.0005 in.	0.00065 in.	0.0008 in.	0.0015 in.



This sectional 4-stage progressive lamination die is used in high-speed automatic presses. Quick replacement of one or several "pie-sections" is possible in case failure occurs

RECONVERSION

SECTION OF AMERICAN MACHINIST

Pontiac Retools Two Plants

CAREFUL PLANNING and teamwork made possible an involved plant rearrangement for reconversion without interrupting important war work at the Pontiac Motor Division of General Motors. Almost 400 operating machines had to be moved, and 70,000 square feet of space had to be cleared to accomplish this.

Before the war, Plant 5 was the Pontiac gear and axle plant. With the war, the plant had gradually been taken over for M24 tank axles. The tank axle job was recently reduced, but still was in operation. Meanwhile, Plant 11 was made idle by a contract termination. With new car production in prospect, the company's problem was to re-establish its gear and axle department without letting up on the tank axle job.

It was decided to move the tank axle job from Plant 5 to Plant 11, and restore Plant 5 for gear and axle production by re-installing necessary equipment held in storage, and utilizing such equipment as was no longer needed for the tank axle job. This made it necessary to clear 70,000 sq. ft. of plant space, move a washer 40 ft. long, some 800 ft. of monorail conveyor, 500 ft. of dead roller conveyor, together with hoists, tools, stands, gages and other equipment, besides shifting 385 machines.

Moving 385 Machines

First of all, the department heads were called together by S. W. Ostrander, general manufacturing manager. J. P. Kennedy, chief of standards, was asked to prepare a schematic sketch of departmental areas in Plant 11, allowing 115 sq. ft. for each machine. Layout men first made a rough sketch, blocking out departments in color, and then made a board layout on a quarter-inch scale.

After scanning the layout, it was decided to move 229 machines to Plant 11; 86 others would not be needed on the tank job, but could be moved out of Plant 5, too, since they were not usable on the gear and axle job, either. However, 70 other machines could be left in Plant 5, but had to be rearranged.

Department heads and foremen then scrutinized the proposed board layout, and changes were made until all agreed that the best possible scheme had been attained. Then the layout was photographed, the prints enlarged, and copies sent to all department heads.

Meanwhile, careful consideration was being given to the order in which machines should be moved. The down time of these machines, while they were being shifted or rearranged, was estimated and a large leeway allowed against unforseen delays. In some cases, estimates doubling the expected down time were made for safety's sake. These estimates made it possible to calculate what banks of parts were necessary to maintain the rest of the operation at all times. These banks of parts were run off as quickly as possible, some of the machines being operated even at lunchtime, to accumulate the amounts required for the changeover.

Foremen were consulted on the sequence in which machines were to be moved. Decisions were based principally upon the banks of parts on hand and the estimated down time of the individual machine. This naturally differed as between various precision machines and large Bullard Mult-Au-Matics, Nateo two-way boring mills, and DeVleig boring machines with a double base.

From these consultations, a schedule was made up of which machines to be moved on certain days. Not only were the tank machines scheduled this way, but also those machines to be taken from storage and set up in the gear and axle line were also listed in this manner. Although only a few axle machines could be disturbed at one time, as many as 75 units were moved in a single day.

To secure manpower for shifting the machines, recourse was made to the company records on past model changes, so that men who had been helpers during these changes could be selected. Most of these men were found to be working on production jobs, and foremen were reluctant to let them go. However, they were persuaded that the men were necessary to handle the changeover successfully.

As soon as the new plant layout had been approved, conveyors were installed in Plant 11. Some spare rail was used at first and then conveyors in use in Plant 5 were ripped out and moved to Plant 11.

Tools Carefully Handled

Since rail spurs serve each plant, many of the larger or more delicate machines were loaded on flat cars and moved by rail. Tractors and skids were used for others.

The Standards section issued the move orders and the plant engineer ordered millwrights, electricians, pipefitters and others to set up the machines. Each machine was tagged and the workers who set it up and tested it, signed on a special space on the tag for that purpose.

Machines were set up and placed in operation as fast as they were moved. Tank machinery was working in Plant 11 and Plant 5 at the same time. There was no lag in output of tank axles.

At the same time, the automotive machines were being installed ready to turn out spare parts. The job, normally one which would take a couple of days, took two weeks. But the important thing was that no production time was lost.

A similar transition is taking place in another section of Pontiac. The

Planning the new plant layout, calculating down time and getting the teamwork of all those qualified helped Pontiac shift tank axle work to a different plant without retarding output

Transfer of equipment from one plant to another involved plenty of heavy work as demonstrated by the resetting of the huge press (right). Production is underway in one section of the transplanted tank axle plant. This gives an idea of the tremendous amount of plant layout work involved in removing the equipment from Plant 5 and setting it up again in Plant 11 without any lag in war production tasks

division has been making diesel engine parts for Detroit Diesel Engine. The latter is now taking over the work and the job is being moved piecemeal, while the plant is being reconverted to make Pontiac engines

Engineers of Detroit Diesel have been studying the moving job and have notified Pontiac how long it will take them to get into production on the parts they are taking over. Pontiac is running a bank of parts to tide it over while the machines are enroute to Detroit.

This is only the beginning for Pontiac. Its final assembly plant is still full of war work. But already plans are underway to clear it and move the other assignments elsewhere. In all, it will move about 2,000 machines.

CEMENTED-CARBIDE WAYS Increase Accuracy of Tool Grinder

BY JAMES R. LONGWELL, CARBOLOY COMPANY

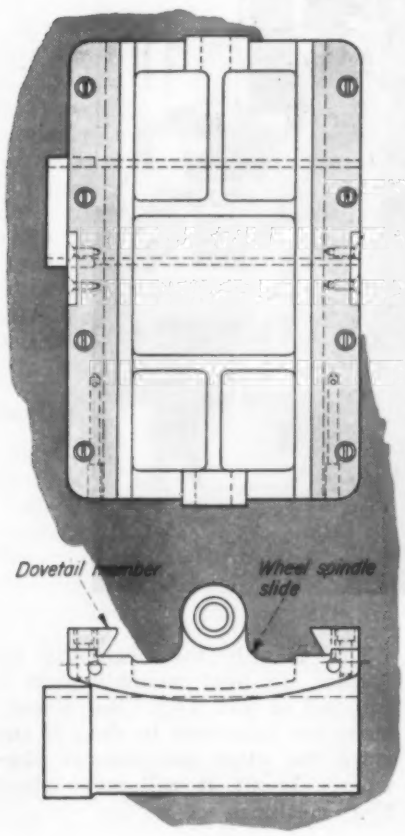
The replacement of cast iron dovetail slides and ways with cemented-carbide members adds precision to profile grinding over long periods of service

CEMENTED CARBIDES have just gained another useful and special application. This time they facilitate and improve the finishing of carbide-tipped form tools made in the Carboloy plant. These tools are generally finished on Wickman profile grinders with diamond wheels and the pressures required are materially higher than those required for grinding steel tools. And, because of the high degree of precision required in grinding the form tools, no looseness is permitted in the spindle or the ways of the grinder.

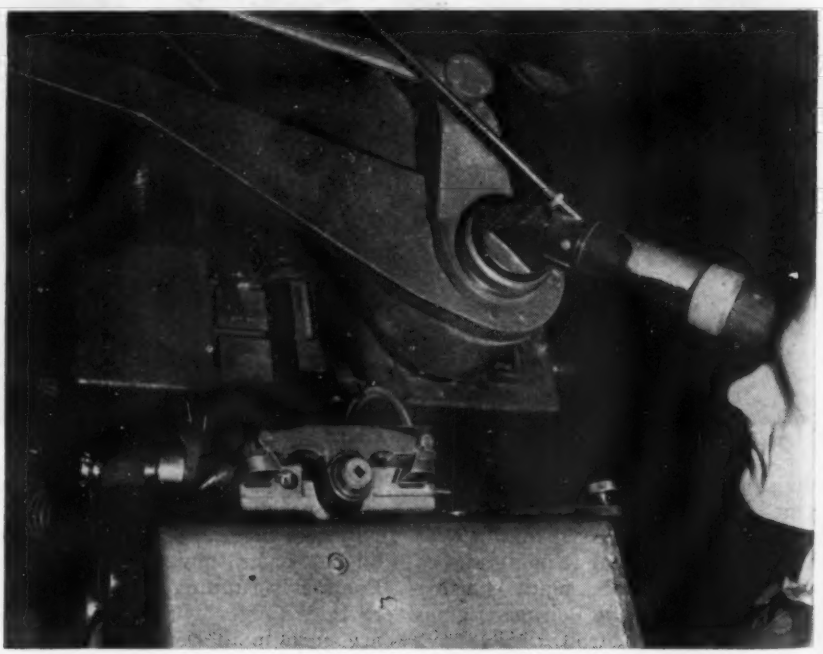
In the Wickman grinder the wheel spindle is carried on a vertical slide which reciprocates vertically at either 40 or 80 strokes per minute. The higher speed is used almost exclusively in the grinding of carbide-tipped form tools. The length of stroke is adjustable and the maximum stroke is 3 in.

The vertical slide originally furnished was provided with cast iron ways. Because production requirements made it necessary to use the profile grinders throughout two 8-hr. shifts per day, the gib in the ways of the vertical slide had to be adjusted every 24 hr. to maintain the required accuracy. The cast iron ways and the gib on this vertical slide wear to such an extent that they must be removed and scraped back to a plane surface about once every six months under these conditions.

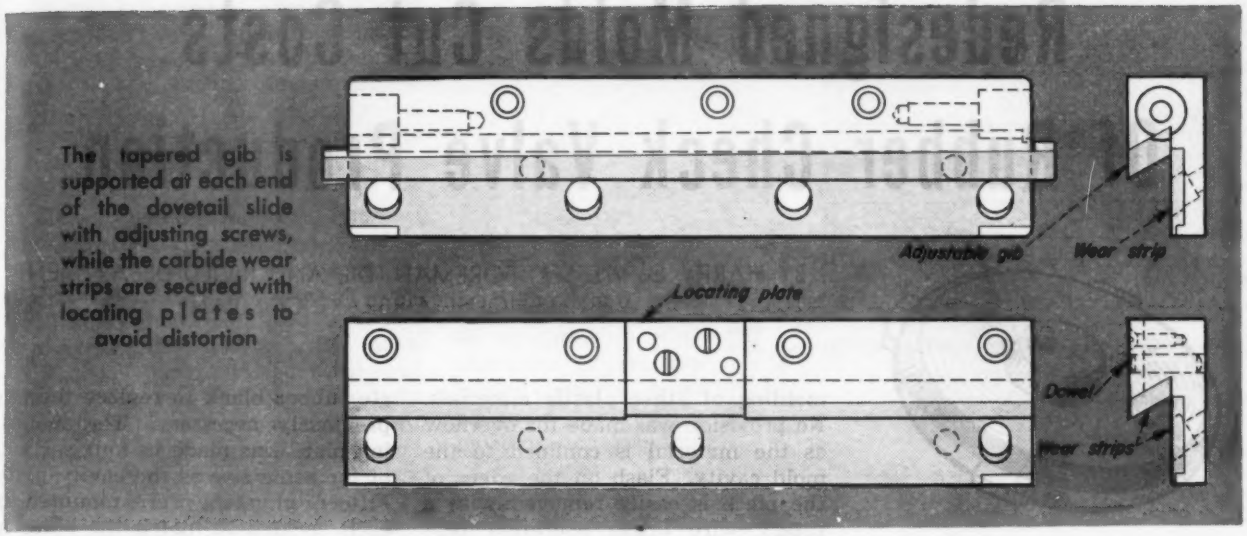
In an effort to lengthen the life of the ways and guarantee greater accuracy over a longer period of service solid cemented-carbide dovetail ways and wear strips were installed on one machine. The ways consist of two upright dovetails, each about 9¾ in. long, 1 in. wide and ½ in. thick. Bearing directly against these dovetails are two inserts on one side of the head, and an insert and a tapered gib on the other side. These cemented-carbide inserts are 8½ in. long, 1 in. wide and 3/16 in. thick. Thus, all bearing surfaces are of solid cemented carbide. The carbide sections have oil grooves ground into their surfaces and the machine oil is fed by gravity from oil cups.



Two solid carbide dovetail members are mounted on the wheel spindle slide as shown and are held in place by a locating plate and cap screws. An oil groove is ground into the bearing surfaces



These cemented-carbide ways, gib and wear strips installed on this Wickman profile grinder, show no wear after nearly a year of service


The tapered gib is supported at each end of the dovetail slide with adjusting screws, while the carbide wear strips are secured with locating plates to avoid distortion
Adjustable gib
Wear strip
Locating plate
Dowel
Wear strips

These carbide ways have now been used for more than seven months on two 8-hr. shifts a day, and no sign of wear has yet been detected. The gib was adjusted once after a running period of 30 days and since then no readjustment has been necessary.

As indicated in an accompanying sketch the vertical slide casting for the wheel spindle member was machined to facilitate mounting two solid cemented-carbide dovetail members. These dovetail members were finish ground and diamond lapped before mounting on the slide casting and each member fastened to the casting with four 5/16-24 fillister-head screws. At each side of the slide a cold-rolled steel locating plate fits into a slot in one side of the cemented-carbide dovetail member to prevent end movement.

The two cast iron dovetail members originally mounted on the grinder to support the vertical spindle slide were machined to take the cemented-carbide wear strips and tapered gib member. The tapered gib is finished with a taper of ⅛ in. per ft. and is supported at each end with adjusting screws in the conventional manner.

Crush Formed Wheel Dresses Four-Tooth Milling Cutter

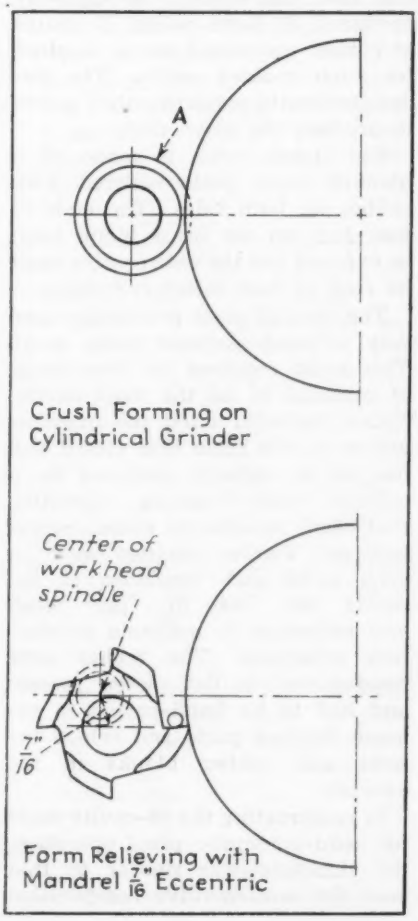
BY R. A. SCHLUTZ, FOREMAN
NOBLETT & FORREST, SOUTH AUSTRALIA

SOME TIME AGO, there appeared an article about the crush forming of grinding wheels. This idea has been put to use in our shop for relief forming of involute gear cutters in a plain cylindrical grinder. A plain carbon steel roller was face-formed, roughly fluted and hardened. This was mounted on an arbor in the workhead of the grinder. With the wheel motor off, the rotating former was brought into contact with the wheel. This roller was forced into the revolving grinding wheel.

In place of the concentric arbor, an arbor with an eccentricity of 7/16 in. was used. Form relief in the cutter was ground by rocking each tooth past the previously formed rotating grinding wheel. A pin in the face of the eccentric arbor assures concentricity of the cutting edge with the bore. This method requires only two arbors, one concentric and one eccentric type.

The ground-relief four-tooth cutters are definitely superior to the conventional cutter because the tooth form is the same at all positions of the cutting edge.

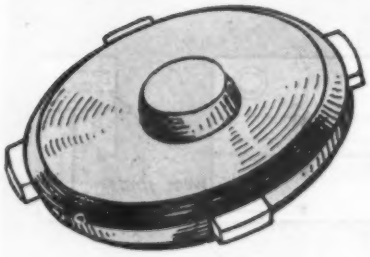
To finish eleven tooth, 10 D.P. involute gears from phosphor bronze required only one regrind at 500 gears and 900 were machined at a speed of 630 r.p.m. with 18 in. per minute feed. These speeds and feeds may appear exaggerated, but they are correct. The cutter was not carbide tipped, but was an 18 percent tungsten steel.



Above—The wheel was crush formed with a hardened steel roll. Below—The machined cutter was mounted on an eccentric arbor and each tooth rocked past the crush formed face of the abrasive wheel

Redesigned Molds Cut Costs Of Rubber Check Valve Production

BY HARRY G. WESSEL, FOREMAN, DIE AND MOLD DEPARTMENT
WESTINGHOUSE AIRBRAKE COMPANY



A mold redesigned for operation on a semi-automatic mold press saved 57 percent of rubber used and improved quality of parts

CONSTRUCTION of a new design of mold for a rubber check valve resulted in savings in production cost, labor and rubber. As originally produced, in hand molds, 11 grams of rubber compound were required for each molded valve. The redesigned mold requires only 7 grams to produce the same part.

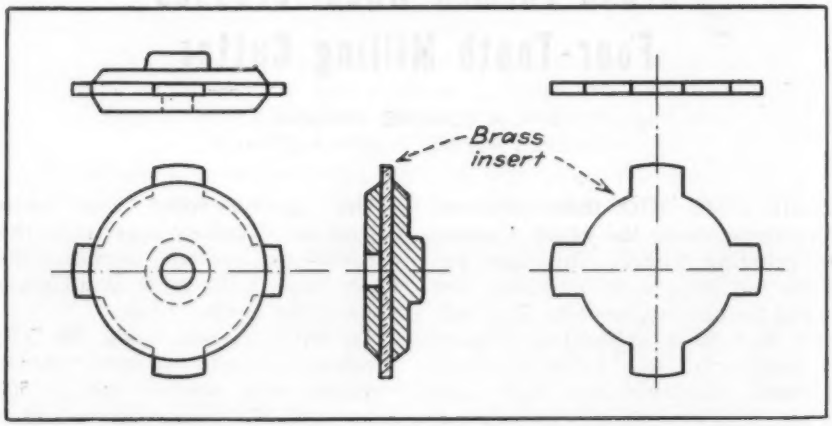
The check valve is made of a blanked brass plate covered with rubber on both sides. The ends of four lugs on the brass blank must be exposed and the entire valve must be free of flash when completed.

The type of mold previously used was a hand-operated flash mold. This mold required an overcharge of material to fill the mold cavity. Excess material filled the overflow groove as the mold was closed and had to be entirely removed by a tedious wire-brushing operation that often resulted in excessive rejections. Twelve cavities were in each mold and operation of six molds for 144 hr. per week was necessary to maintain production schedules. The molds were hand-placed in flat platen presses and had to be hand-parted to remove finished parts and reload inserts and rubber blanks in the cavities.

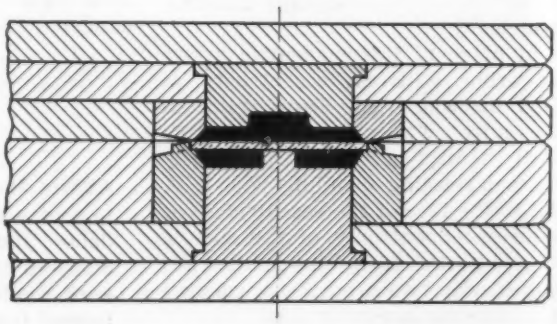
In constructing the 60-cavity mold for semi-automatic press operation, the structure was similar to that used for semi-positive compression molding of other plastic materials. No provision was made for overflow as the material is confined to the mold cavity. Flash on the edges of the piece is easily removed with a rotary wire brush operation performed by the press operator in the 20 min. curing interval. Parts produced are sufficiently satisfactory to permit abandonment of 100 percent inspection procedures.

As the 60-cavity mold covered a large area, the cavity and mounting plates were made in sections. The four slots in each cavity were broached to a close fit for the lugs on the brass inserts. The upper edge of the broached holes was tapered to permit the insert to drop into position in the mold and allow a single rubber blank to replace the two previously necessary. The mounting plate was made in four sections of the same size as the cavity plate. Fifteen plungers were mounted in each, located to match the holes in the cavity plate. The upper plungers were made a sliding fit in the cavity plate holes and the lower plungers were tapped to fit the ejector pins, which were of the self-aligning type with a head machined to slide freely in the tee slots in the knockout bar.

Hardened steel plates were placed between the mold sections and heating platens to prevent molding pressure from forcing the plungers into the mild steel heating platens. Placed between the cavity plates and the hardened steel buffer plates



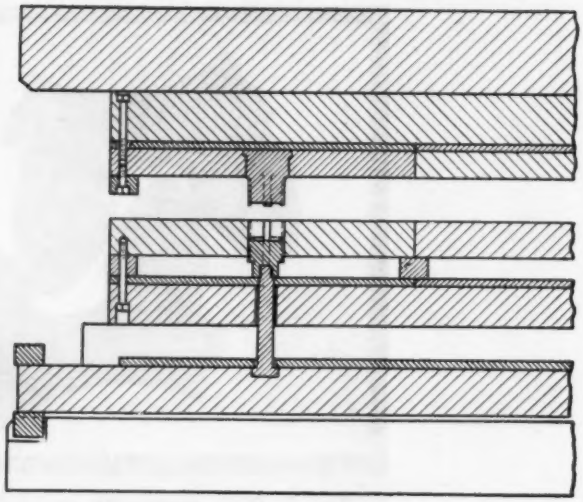
The brass insert must be molded in rubber and completely inclosed except for the four lugs which must be exposed and free of rubber



The original hand-operated molds were cumbersome and wasted rubber

are three hardened steel supports which leave an opening between the plates to provide an escape for any flash that may work down past the lower plungers. A hardened steel stop is located at each end of the mold to assure proper part thickness.

The press is operated by one employee on each shift and requires no exceptional skills for its operation. Operating procedure consists of loading the press with inserts and rubber blanks, starting the press with the pushbutton control and then proceeding to remove the light flash from the previous charge. At the expiration of the 20 min. curing period, the press opens.



The molds designed to be operated on semi-automatic presses are landed-positive types equipped with double plungers and knockout pins

Combined Tooling Eliminates Second Operation

DISCUSSION

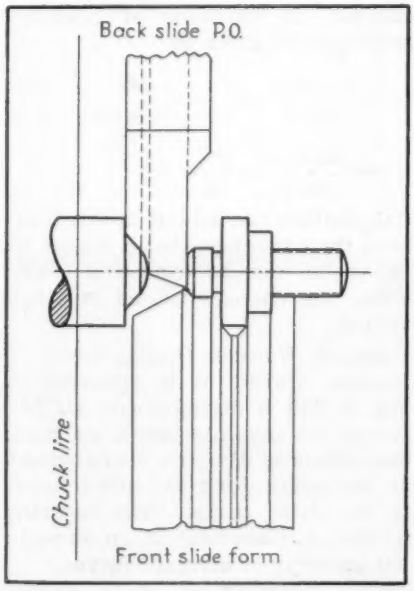
BY CHARLES STANLEY PETTIT, COVENTRY, ENGLAND

SOME TIME AGO, there appeared an article about turning small parts. The part shown could be made by the "Birmingham" method in 12½ seconds without burrs and pips.

The layout shows the application of the turning tools which consist of forming to finished shape by the front slide former and parting-off by a tool held in the back slide. A support from the turret is included and this takes the form of a semi-circular holder attached to the turret. Its purpose is to maintain the piece in position while forming and parting-off operations take place. This support is backed-off when the piece is 91 percent severed. The slide tools begin to operate together immediately after the die is run-off, the semi-circular support coming into use after the turret is double indexed. No time is allowed for this because the tools are all clear.

Limits are held and the treading and forming are done while the work is in its most suitable and strongest state. The total time of operations was 12½ sec. divided as shown by the table.

It will be noticed that the tooling is simple and the workpiece is supported during forming. The feeds are not excessive; if a heavier feed had been used, there is the possibility that the cutting load would deflect the workpiece and result in inaccuracy. The surface speed is about correct.



Small parts can be turned in short time without burrs and pips

Operation	Travel	Feed	Rev.	Percent Individual	Percent Cumulative
Feed to stop			20	4	4
Index			20	5	9
Turn 0.0965 dia.	0.165	0.002	82	19	28
Index & Reverse			20	5	33
Die on			28	6½	39½
Die off			11	2½	42
Index twice	No revs. allowed				
Parting-off and end-up	0.145	0.0006	241	55	97
Clear tools			10	3	100
Total rev.			432		
Overlapping operations					
Form	0.090	0.0005	180	42	42/84
Support			170	39	52/91
Index twice			40	9	100

Time to make piece $\frac{432 \times 60}{2048} = 12\frac{1}{2}$ seconds

Spindle speeds: 792 forward, 2048 reverse

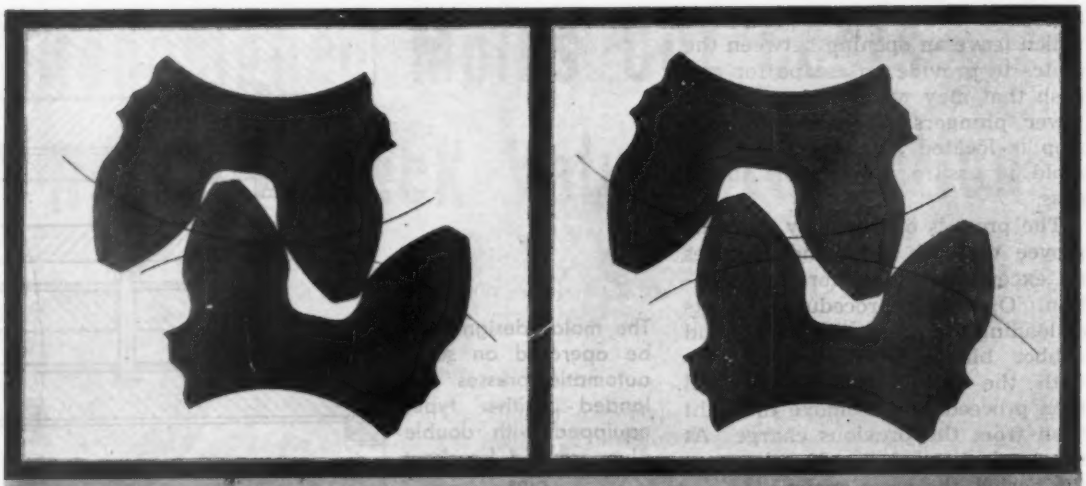


Fig. 1—Gear teeth with no backlash. Profiles touch on both sides of teeth. Pitch circles touch each other. Fig. 2—Same teeth with center distance increased. Profiles touch on only one side of teeth, with backlash between other sides. Original pitch circles are separated

Involute Gear Calculations Simplified

BY ALLAN H. CANDEE, GLEASON WORKS

Tables of a factor *k* derived for changes in center distance and tooth thickness provide a short cut when designing and generating involute spur gears

IN DESIGNING, generating, and checking involute gear teeth, calculations must be made for changes of center distance, pressure angle, circular thickness and backlash. The purpose of this article is to present and explain methods of calculation which are shorter and more direct than those usually employed for problems involving changes of center distance.

Pressure Angles and Diameter. In a given gear the base diameter D_b is a fixed dimension, but contact with a mating gear may be at a varying pitch diameter D. The involute curve has a different pressure angle ϕ at different points, starting with 0-angle at the base circle and increasing continually with increase of diameter. In the simple equations

$$\cos\phi \frac{D_b}{D} = \frac{\text{base diameter}}{\text{pitch diameter}}$$

$$\text{and } \sec\phi = \frac{D}{D_b},$$

it is to be noted that the cosine of the pressure angle is inversely proportional to diameter and the secant is directly proportional.

Pressure Angle and Center Distance. When two gears are in mesh, the sum of the pitch diameters equals twice the center distance $D + d = 2C$, and the base diameters D_b and d_b remain constant. For any given center distance the pressure angle can be determined by the equations

$$\cos\phi = \frac{D_b + d_b}{2C}$$

$$\text{and } \sec\phi = \frac{2C}{D_b + d_b}$$

Here similarly the cosine is inversely proportional to center distance and the secant is directly proportional.

Symbol Δ for Differences and Changes. In calculations of changes it is convenient to use the symbol Δ to indicate an increment or difference. Thus ΔC is shorter to write than $C_2 - C_1$, and $\Delta \cos\phi$ saves both space and thought as compared with $\cos\phi_1 - \cos\phi_2$. This is expressed more consistently as $\Delta\cos\phi = \cos\phi - \cos(\phi + \Delta\phi)$.

Proportional Differences. Continuing with the principle of proportionality, the relationship between changes of center distance and changes in functions of pressure angle can be given as

$$\frac{\Delta\cos\phi}{\cos\phi} = -\frac{\Delta C}{C + \Delta C}$$

$$\text{and } \frac{\Delta\sec\phi}{\sec\phi} = \frac{\Delta C}{C}$$

Calculations carried out in this form have the advantage that a change in one value can be compared easily with the changes caused in other values.

Constant Normal Displacement of Involute Curve. It is apparent in Fig. 3 that a displacement Δt_n between two involute curves on their base circle is also the displacement at any point along the line tangent to the base circle. This constant normal displacement is an important property of involute curves.

Changes of Thickness. In machining and grinding involute gear teeth by generating processes, tooth thick-

ness is varied usually by changing depth of cut, and sometimes by changing tool dimensions or settings. It is well known that such changes do not affect the diameter D_b of the base circle in a given gear. If one side of an involute tooth is considered as fixed and the thickness is changed, the involute curve of the other side is displaced about the gear center. See Fig. 4. At any point the amount of such displacement circumferentially is proportional to the radius or diameter at that point. Then if displacements and diameters are designated as

Δt_b at D_b, Δt_1 at D_1, Δt_2 at D_2

relationships like the following are readily apparent:

$$\Delta t_1 = \frac{D_1}{D_b}\Delta t_b; \quad \Delta t_2 = \frac{D_2}{D_b}\Delta t_b; \text{ and}$$

$$\Delta t_2 = \frac{D_2}{D_1}\Delta t_1$$

Also, with similar subscripts applied to pressure angle ϕ,

$$\Delta t_1 = \frac{\Delta t_b}{\cos \phi_1}, \quad \Delta t_2 = \frac{\Delta t_b}{\cos \phi_2}, \text{ and}$$

$$\Delta t_2 = \frac{\cos \phi_1}{\cos \phi_2}\, t_1$$

Backlash and Tooth Thickness. The relation between backlash and circular thickness is expressed by the simple equation $B = p - (t_G + t_P)$, meaning that backlash B equals circular pitch p minus the sum of the gear circular thickness t_G and the pinion circular thickness t_P. Of course the values are those which exist on the pitch circles. Measurements of tooth thickness and backlash taken at positions not exactly on the pitch circles can easily be corrected when exact calculations are to be made.

A decrease in circular thickness Δt results in an increase in circular backlash ΔB. Because of this direct connection, the same symbol Δt may sometimes be used for a change of either thickness or backlash.

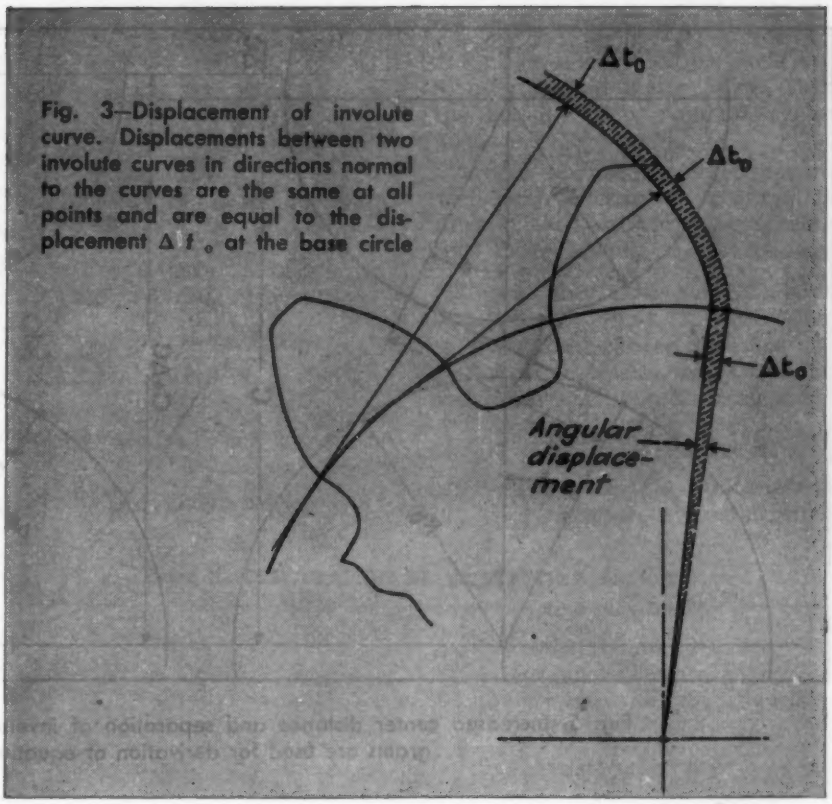


Fig. 3—Displacement of involute curve. Displacements between two involute curves in directions normal to the curves are the same at all points and are equal to the displacement Δt_0 at the base circle

Rack and Gear. In the case of a rack and gear, when the depth of engagement is decreased, the backlash is increased. A hob generating a spur gear acts like a rack in many respects: when the depth of cut is increased, the tooth thickness of the gear is decreased.

Since involute rack profiles are straight, a given rack can have only one pressure angle; and a gear meshing with a rack has a constant pitch diameter regardless of depth of engagement.

Letting Δh designate a change in depth, it is correct to calculate the corresponding change in circular thickness as

$$\Delta t = (2 \tan \phi)\ \Delta h.$$

A change in depth of engagement with a rack corresponds to a change in center distance between two gears; and the factor 2 tan ϕ is sometimes used to estimate changes of tooth thickness when the center distance is varied. Figures so obtained, however, are only approximate, and the error increases rapidly with the amount of change.

Two Involute Gears. When the center distance of two external spur gears is increased, the backlash is increased. It is often desired to calculate the change in backlash for a given change in center distance, and vice versa. A directly similar problem occurs when the center distance between an involute gear-shaper cutter and a gear being generated is decreased, for instance, and the tooth thickness of the gear is decreased.

In these cases there is a change to different pitch diameters in the generating operation and a change of pressure angle. For making exact calculations the shortest and most direct equation* is

$$\Delta t = 2\ C\ \Delta \text{ inv } \phi, \qquad (1)$$

in which Δt is the change in circular thickness on the original pitch circles and Δ inv ϕ = inv $(\phi + \Delta\phi)$ — inv ϕ.

*Equation (1) was derived by the

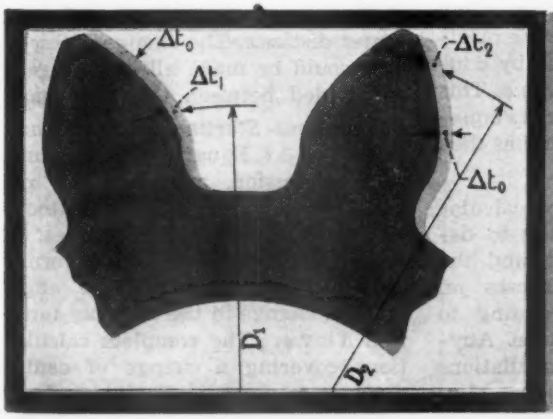


Fig. 4—Changes in tooth thickness on different circles in an involute gear are proportional to diameter

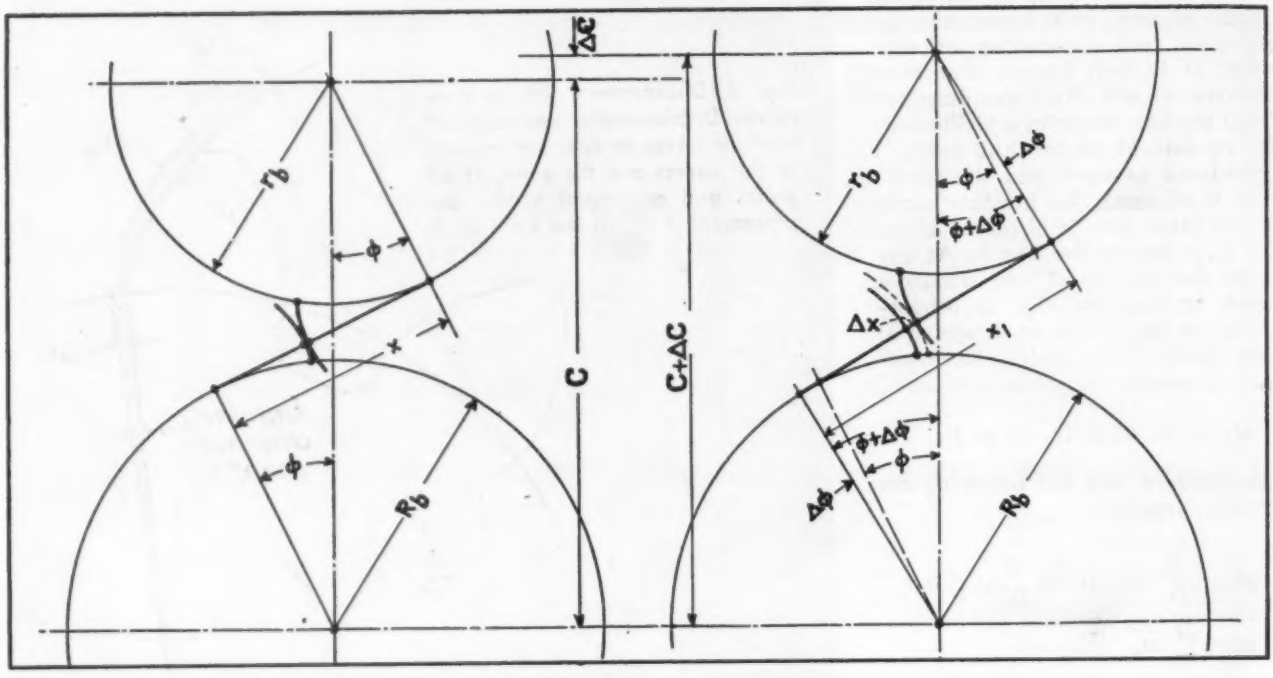


Fig. 5—Increased center distance and separation of involute curves. These diagrams are used for derivation of equation 1

author in 1929 and has been in use by him since that time. An equivalent expression was given by John D. Howell in *Machine Design*, April, 1942, p. 108.

Derivation of Equation (1). For a simple derivation, refer to Fig. 5, where the same two base circles with radii R_b and r_b are shown first at one center distance and then at an increased center distance.

Left Diagram

C = original center distance
ϕ = original pressure angle
$R_b + r_b = C \cos \phi$
x = original length of line of action
$= (R_b + r_b) \tan \phi$
$= C \cos \phi \tan \phi$

Right Diagram

$C + \Delta C$ = increased center distance
$\phi + \Delta\phi$ = increased pressure angle
$R_b + r_b = (C + \Delta C) \cos(\phi + \Delta\phi)$
x_1 = increased length of line of action
$= (R_b + r_b) \tan (\phi + \Delta\phi)$
$= C \cos \phi \tan (\phi + \Delta\phi)$
Δx = separation of involute curves which were originally tangent

By inspection of the diagrams it is seen that

$$x_1 = x + \Delta x + (R_b + r_b)\ \Delta\phi$$

from which

$$C \cos \phi \tan (\phi + \Delta\phi) = C \cos \phi \tan \phi + \Delta x + C \cos \phi\ \Delta\phi$$

$$\Delta x = C \cos \phi\ [\tan (\phi + \Delta\phi) - \tan \phi - \Delta\phi]$$

$$\Delta x = C \cos \phi\ \Delta \text{ inv } \phi \qquad (2)$$

In equation (2), Δx is the separation on the line of action between two involutes originally tangent to each other and then moved apart by an increase in center distance. At the right, a second involute on the lower base circle and tangent to the upper involute has been dotted in; and Δx is seen to be equal to a displacement on the lower base circle. The circumferential displacement at any other circle can be obtained by dividing Δx by the cosine of the corresponding pressure angle.

Furthermore, Δx is the separation that occurs on one side of a tooth—the same amount of separation occurs on the other side. Therefore, the backlash, or corresponding change of thickness Δt, on the original pitch circles, is obtained by doubling Δx and dividing by cos ϕ. This gives $\Delta t = 2\ C\ \Delta \text{ inv } \phi$ which is equation (1); and the derivation has thus been made.

Example. The method of calculation most commonly used is to determine the circular pitch and the individual circular thicknesses on the pitch circles corresponding to the increased center distance. Anyone who has made such calculations will appreciate the extreme simplicity of equation (1). Assume two standard gears with 20 and 40 teeth, 4 D.P., 20-deg. pressure angle, and with tooth thicknesses such that there is no backlash when the gears are set at the "standard" center distance of 7.500 in. Assume further that it is required to calculate how much the backlash will be when the center distance is increased and the pressure angle becomes 20 deg. 51 min. The numerical values are as follows:

$$\text{inv } 20°\ 57' = 0.0169621$$
$$\text{inv } 20°\ 0' = 0.0149044$$
$$\Delta \text{ inv } \phi = 0.0020577$$
$$\Delta t = 2 \times 7.500 \text{ in.} \times 0.0020577$$
$$= 0.0308 \text{ in.}$$

Although in this example Δt is calculated as a change from 0-backlash, it might also be thought of as a change of thickness on the standard pitch circles, which would cause the gears to mesh without backlash at the increased pressure angle and center distance. The change of thickness could be made all on one gear or divided between the two gears.

Calculations Starting With ΔC and Obtaining Δt. Equation (1) is a compact expression, and does not require the determination of tooth thickness on new pitch circles. It does require, however, the determination of the new pressure angle and the change in the involute function Δ inv ϕ. The complete calculations covering a change of center distance is given in Table 1.

Calculations Starting With Δt and Obtaining ΔC. Determinations can be made just as easily in the reverse direction, starting with a change in backlash or thickness and obtaining the change in center distance, as shown in the accompanying tabulation in Table 2.

Short Method, When Original Pressure Angle Is Standard. The foregoing methods of calculation can be applied whether the starting dimensions C and ϕ are standard or not. It is necessary to make several interpolations in trigonometric tables, as for $(\phi+\Delta\phi)$, inv $(\phi+\Delta\phi)$, and cos $(\phi+\Delta\phi)$ or sec $(\phi+\Delta\phi)$. For cases where the original pressure angle is standard (20 deg. or 14 deg. 30 min.), it is possible to arrive at a method in which only one interpolation is necessary. This is done by calculating and tabulating values of $k=\frac{\Delta t}{\Delta C}$. Then if ΔC *is given,* $\Delta t = k\,\Delta C$; and if Δt is given, $\Delta C = \Delta t/k$.

Values of k have been determined for values of both $\frac{\Delta C}{C}$ and $\frac{\Delta t}{C}$.

In the first case, $\Delta \sec\phi = \frac{\Delta C}{C}\sec\phi$.

In the second case, $\Delta \text{inv}\,\phi = \frac{1}{2}\left(\frac{\Delta t}{C}\right)$.

In both cases, $k=\frac{\Delta t}{\Delta C}$

$$=\frac{2\,C\,\Delta \text{inv}\,\phi}{\frac{\Delta \sec\phi}{\sec\phi}\,C}$$

$$=\frac{2\,\Delta \text{inv}\,\phi}{\frac{\Delta \sec\phi}{\sec\phi}}$$

The results arranged for actual use are given in Tables 3, 4, 5 and 6. These tables were the immediate reason for the preparation of this article. Their use will be illustrated by several examples.

Explanation of Use of Tables

Notation:

C = standard center distance $= \frac{\text{sum of numbers of teeth}}{2 \times \text{(diametral pitch)}}$

ΔC = change from standard center distance, which may be either plus or minus

Δt = corresponding change in circular thickness or in backlash, at standard pitch circles

k = value to be taken from tables $(k = \Delta t/\Delta C)$

Example No. 1—Change of Center Distance Given. When the change ΔC from standard center distance is given, calculate $\frac{\Delta C}{C}$ and take value of k from Table 1 or 5, interpolating if necessary.

Then the change in circular thickness $\Delta t = k\,\Delta C$.

Given: $C = 3.000$ in.; pressure angle $= 20$ deg.; $\Delta C = 0.012$ in.; Then

$\frac{\Delta C}{C} = +0.004$; $k = 0.8252$;

$\Delta t = 0.8252 \times 0.012$ in. $= 0.0099$ in.

Example No. 2—Change in Circular Thickness Given. When the change Δt in circular thickness on standard pitch circle is given, calculate $\frac{\Delta t}{C}$ and take value for k from Table 4 or 6, interpolating if necessary. Then the change from standard center distance $\Delta C = \Delta t/k$.

Given: standard enlarged pinions with tooth thicknesses according to the published standards of the American Gear Manufacturers Association and the American Standards Association; 12 and 15 teeth; 1 diametral pitch; 20 deg. pressure angle; circular thicknesses 1.7878 in. and 1.6601 in.; backlash 0.020 in.

$C = \frac{12+15}{2\text{x}(1\text{ D. P.})} = 13.500$ in.

$\Delta t = (\text{thickness})_1 + (\text{thickness})_2 + \text{backlash} - \text{circular pitch}$

Table 1—CALCULATION OF Δt, STARTING WITH ΔC

C	original center distance
ϕ	original pressure angle
ΔC	change in center distance
$\sec\phi$	from table
$\Delta \sec\phi = \frac{\Delta C}{C}\sec\phi$	change in sec ϕ
$\sec(\phi+\phi\Delta) = \sec\phi + \Delta\sec\phi$	new value of secant
$(\phi+\Delta\phi)$	new pressure angle, from table
inv $(\phi+\Delta\phi)$	from table
inv ϕ	from table
$\Delta \text{inv}\,\phi = \text{inv}\,(\phi+\Delta\phi) - \text{inv}\,\phi$	change in involute function
$\Delta t = 2\,C\,\Delta \text{inv}\,\phi$	change in thickness or backlash on original pitch circles

Example. The use of this form is illustrated by the following numerical example:

$C = 5.000$ in.	$(\phi+\Delta\phi) = 22.888$ deg.
$\phi = 20$ deg.	inv. $(\phi+\Delta\phi) = 0.0227015$
$\Delta C = 0.100$ in.	inv $\phi = 0.0149044$
$\sec\phi = 1.0641778$	$\Delta \text{inv}\,\phi = 0.0077971$
$\Delta \sec\phi = 0.0212836$	$\Delta t = 0.078$
$\sec(\phi+\Delta\phi) = 1.0854614$	

Table 2—CALCULATION OF ΔC, STARTING WITH Δt

C	original center distance
ϕ	original pressure angle
t_1	original thicknesses
t_2	increased thicknesses
$\Delta t = t_2 - t$	increase in thickness
inv ϕ	from table
$\Delta \text{inv}\,\phi = \frac{\Delta t}{2C}$	from equation (1)
inv $(\phi+\Delta\phi) = \text{inv}\,\phi + \Delta\,\text{inv}\,\phi$	new value
$(\phi+\Delta\phi)$	new pressure angle, from table
cos ϕ	from table
cos $(\phi+\Delta\phi)$	from table
$\Delta\cos\phi = \cos\phi - \cos(\phi+\Delta\phi)$	change in cos ϕ
$\Delta C = \frac{\cos\phi}{\cos(\phi+\Delta\phi)}C$	increase in center distance

CHANGE in CENTER DISTANCE and TOOTH THICKNESS

INVOLUTE GEAR TEETH of 20-DEG. STANDARD PRESSURE ANGLE

TABLE 3			TABLE 4		
ΔC = change in center distance C			Δt = change in circular thickness t		
$\frac{\Delta C}{C}$	$k=\frac{\Delta t}{\Delta C}$	Diff.	$\frac{\Delta t}{C}$	$k=\frac{\Delta t}{\Delta C}$	Diff.
—0.040	0.5969	195			
—0.035	0.6164	183			
—0.030	0.6347	173	—0.024	0.5957	323
—0.025	0.6520	166	—0.020	0.6280	259
—0.020	0.6686	159	—0.016	0.6539	218
—0.015	0.6845	151	—0.012	0.6757	192
—0.010	0.6996	144	—0.008	0.6949	173
—0.005	0.7140	139	—0.004	0.7122	157
0.000	0.7279		0.000	0.7279	
+0.005	0.7414	135	+0.004	0.7424	145
+0.010	0.7545	131	+0.008	0.7560	136
+0.015	0.7672	127	+0.012	0.7687	127
+0.020	0.7794	122	+0.016	0.7806	119
+0.025	0.7913	119	+0.020	0.7919	113
+0.030	0.8029	116	+0.024	0.8027	108
+0.035	0.8142	113	+0.028	0.8130	103
+0.040	0.8252	110	+0.032	0.8228	98
+0.045	0.8359	107	+0.036	0.8322	94
+0.050	0.8464	105	+0.040	0.8413	91
+0.055	0.8566	102	+0.044	0.8500	87
+0.060	0.8665	99	+0.048	0.8584	84
+0.065	0.8762	97	+0.052	0.8665	81
+0.070	0.8858	96	+0.056	0.8744	79
+0.075	0.8952	94	+0.060	0.8821	77
+0.080	0.9043	91	+0.064	0.8895	74
+0.085	0.9132	89	+0.068	0.8968	73
+0.090	0.9220	88	+0.072	0.9038	70
+0.095	0.9306	86	+0.076	0.9106	68
+0.100	0.9391	85	+0.080	0.9173	67
			+0.084	0.9238	65
			+0.088	0.9301	63
			+0.092	0.9362	61
			+0.096	0.9422	60

note when values increase and when they decrease.

For two external gears an increase in center distance results in an increase in backlash.

For a pinion and an internal gear a decrease in center distance results in an increase in backlash.

Example No. 3—Changed Center Distance and Outside Diameters. When a pair of involute gears is generated for changed center distances by standard hobs or cutters, while maintaining a constant amount of backlash, the root diameters do not change exactly with the center distance. Whether the latter is increased or decreased, the effect is always to decrease the dedendums of the teeth; and if the usual clearance is to be maintained, the outside diameters must be properly determined.

Assume that the following information is given:

Total number of teeth ..... $N+n=80$
Diametral pitch ..... $P=4$
Std. pressure angle.... $\phi=20$ deg.
Std. center distance... $C=10.000$ in.
Increase in center distance ... $\Delta C=0.250$ in.
Backlash ..... $B=0.010$ in.

Required: the sum of the outside diameters to make the clearance the same in gears hobbed for the increased center distance as in gears for standard center distance and no backlash.

Calculations. $\frac{\Delta C}{C}=.0.025$. In Table 3, $k=0.7913$. The corresponding increase in circular thickness is $\Delta t = k\,\Delta C = 0.1978$ in., which is without backlash. Allowing for backlash, the increase in thickness on the standard pitch circle is $\Delta t_1 = \Delta t - B = 0.1878$ in.

The corresponding increase in the

$$= 1.7878 + 1.6601 + 0.020$$
$$- 3.1416 = 0.3263 \text{ in.}$$

$$\frac{\Delta t}{C} = \frac{0.3263}{13.500} = 0.0242\ (+)$$

Interpolate in Table 4

$$\frac{0.0242 - 0.024}{0.028 - 0.024} \times 103 = 5.1$$

$$k = 0.8027 + 0.0005 = 0.8032$$

$$\Delta C = 0.3263 \text{ in.}/0.8032 = 0.406 \text{ in.}$$

$$C + \Delta C = 13.906 \text{ in.}$$

Internal and External Gears. The values of k in the tables are correct for both external and internal combinations. It is necessary only to

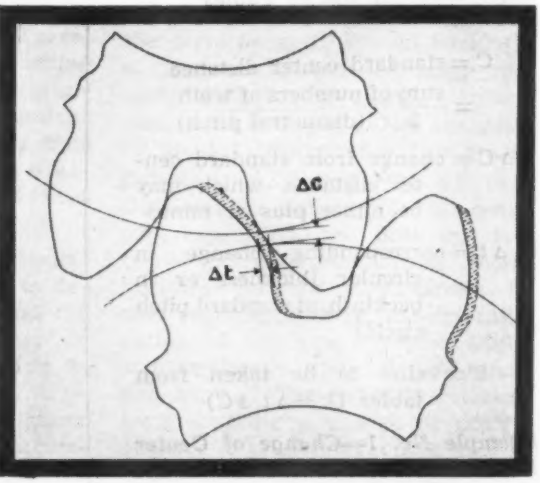


Fig. 6—When center distance between two involute spur gears is changed by ΔC, the amount of backlash is changed. If the center distance between an involute gear-shaper cutter and the gear being generated is changed, the tooth thickness is changed by Δt.

sum of the root diameters is $\Delta D_R = \Delta t_1/\tan \phi = 0.1878/0.364 = 0.516$ in. The increase in the two pitch diameters, of course, is $\Delta D = 2\Delta C = 0.500$ in. Since the root diameters are increased more than the pitch diameters, it is plain that the dedendums are decreased.

Letting D_o designate the sum of outside diameters for standard center distance and standard clearance, and $(D_o)_1$ the sum of the outside diameters for the increased center distance and same standard clearance:

$$\begin{aligned}(D_o)_1 &= D_o + \Delta D - (\Delta D_R - \Delta D)\\ &= D_o + 2\Delta D - \Delta D_R\\ &= D_o + 4\Delta C - \Delta D_R\\ &= D_o + 4 \times 0.0250 - 0.516\\ &= D_o + 0.484 \text{ in.}\end{aligned}$$

It is thus seen that the increase in outside diameters must be less than the increase in pitch diameters, in order to maintain the usual amount of clearance.

Since the tooth thicknesses of the gear and pinion may be different at the standard center distance, and since the increase in thickness may be applied either to one or to both, the figures in this problem are for total changes. The division of such changes between the gear and pinion can be according to the wish of the designer. In an individual gear the root diameter will depend on the specified circular thickness and the dimensions of the hob or cutter.

In case gears are generated by shaping instead of by hobbing, the center distance between a gear and the cutter can be determined from the specified circular thickness of the gear and the measured circular thickness of the cutter. Then the root diameter of the gear

$$D_R = 2C - (D_o)_c,$$

in which $(D_o)_c$ is the measured outside diameter of the cutter.

Example No. 4—Two Enlarged Pinions. To find the center distance of two equal enlarged pinions assembled without backlash. Figures will be determined for 1 D.P. and for the two standard pressure angles. See Table 7.

As part of the problem, root diameters, outside diameters, and clearance will be considered. The clearance c in any gear can be obtained by subtracting from the center distance the sum of the root radius of the gear and the outside radius of its mate, thus:

$$c = C - \frac{D_R + D_o}{2}.$$

CHANGE in CENTER DISTANCE and TOOTH THICKNESS

INVOLUTE GEAR TEETH of 14½-DEG. STANDARD PRESSURE ANGLE

TABLE 5

ΔC = change in center distance C

$\frac{\Delta C}{C}$	$k = \frac{\Delta t}{\Delta C}$	Diff.
—0.020	0.4275	
		253
—0.015	0.4528	
		230
—0.010	0.4758	
		214
—0.005	0.4972	
		200
0.000	0.5172	
+0.005	0.5360	
		188
+0.010	0.5538	
		178
+0.015	0.5708	
		170
+0.020	0.5870	
		162
+0.025	0.6025	
		155
+0.030	0.6174	
		149
+0.035	0.6317	
		143
+0.040	0.6456	
		139
+0.045	0.6590	
		134
+0.050	0.6719	
		129
+0.055	0.6845	
		126
+0.060	0.6967	
		122
+0.065	0.7085	
		118
+0.070	0.7201	
		116
+0.075	0,7313	
		112
+0.080	0.7423	
		110
+0.085	0.7530	
		107
+0.090	0.7634	
		104
+0.095	0.7736	
		102
+0.100	0.7836	
		100
+0.105	0.7933	
		97
+0.110	0.8029	
		96
+0.115	0.8122	
		93
+0.120	0.8214	
		92
+0.125	0.8304	
		90
+0.130	0.8392	
		88
+0.135	0.8478	
		86
+0.140	0.8563	
		85

TABLE 6

Δt = change in circular thickness t

$\frac{\Delta t}{C}$	$k = \frac{\Delta t}{\Delta C}$	Diff
—0.008	0.4362	
		263
—0.006	0.4625	
		210
—0.004	0.4835	
		177
—0.002	0.5012	
		160
0.000	0.5172	
+0.002	0.5316	
		144
+0.004	0.5446	
		130
+0.006	0.5565	
		119
+0.008	0.5677	
		112
+0.010	0.5783	
		106
+0.012	0.5883	
		100
+0.014	0.5977	
		94
+0.016	0.6066	
		89
+0.020	0.6234	
		168
+0.024	0.6389	
		155
+0.028	0.6533	
		144
+0.032	0.6668	
		135
+0.036	0.6795	
		127
+0.040	0.6915	
		120
+0.044	0.7029	
		114
+0.048	0.7138	
		109
+0.052	0.7242	
		104
+0.056	0.7342	
		100
+0.060	0.7438	
		96
+0.064	0.7530	
		92
+0.068	0.7619	
		89
+0.072	0.7705	
		86
+0.076	0.7788	
		83
+0.080	0.7869	
		81
+0.084	0.7947	
		78
+0.088	0.8023	
		76
+0.092	0.8097	
		74
+0.096	0.8169	
		72
+0.100	0.8239	
		70
+0.104	0.8307	
		68
+0.108	0.8373	
		66
+0.112	0.8438	
		65
+0.116	0.8502	
		64
+0.120	0.8564	
		62

A similar expression can be written for changes:

$$\Delta c = \Delta C - \frac{\Delta D_R + \Delta D_o}{2}. \qquad (3)$$

When a gear is generated by hobbing, the increase in root diameter is $\Delta D_R = \Delta t/\tan \phi$ and in the present example the figures are:

0.0893/tan 20 deg. = 0.245 in.

0.2741/tan 14½ deg. = 1.060 in.

In the AGMA and ASA published standards, the increments listed for outside diameters of 15-tooth pinions are $\Delta D_o = 0.2453$ and 1.0598 respectively. These are the same as the foregoing calculated increases in root diameter. The intention, of course, is to maintain the standard whole depth; but probably it was not expected that two of the en-

larged pinions were to run together.

Using these changes in diameter and the calculated changes in center distance in equation (3) the results are:

for 20 deg.

$$c = 0.232 - 0.245 = -0.013 \text{ in.}$$

for 14½ deg.

$$c = 0.805 - 1.060 = -0.255 \text{ in.}$$

The negative sign means that the usual clearance is decreased by these amounts. The decrease of 0.012 in. for the 20-deg. pinions would be allowable in practice; but the decrease of 0.255 in. for the 14½ deg. pinions exceeds any commonly used value of clearance and calls for an alteration in the outside diameter.

If the desired amount of clearance is designated as c_1, the proper outside diameter can be calculated as

$$(D_o)_1 = 2(C_1) - (D_R)_1 - c_1.$$

The figures show that when two enlarged pinions are to be run together, the outside diameters should be checked to see that there is sufficient clearance.

Example No. 5—Pinions with One-Tooth Enlargement. To find the circular thickness at the standard pitch diameter in two equal pinions to run at the center distance which is standard for 20 teeth, when the pinions are generated with 19 teeth. See Table 8.

An allowance for the backlash desired would be subtracted from the increased circular thickness. The determination of outside diameter to result in a given amount of clearance would be made in the same way as in the preceding examples.

Conclusion. The solution of problems concerned with the generation of involute gears for special conditions calls for a familiarity with the geometry of involute teeth and with gear-cutting methods and tools. It is necessary first to recognize what are the known data in a given case and then to know how to determine the unknown dimensions.

In the illustrative examples the determination of change of center distance and change of thickness or backlash is only a part of a given problem. By using the tabulated values of $k = \Delta t/\Delta C$, however, that part of each problem can be calculated in the shortest possible way.

Table 7—CALCULATION OF CENTER DISTANCE OF TWO ENLARGED PINIONS

Pressure angle	ϕ	20 deg.	14½ deg.
Number of teeth	N	15	15
Standard center distance	C	15.000	15.000
Circular thickness (one pinion)	t_1	1.6601	1.8449
Standard circular thickness	t_s	1.5708	1.5708
Increase in thickness (one pinion)	Δt_1	0.0893	0.2741
Increase in thickness (two pinions)	Δt	0.1786	0.5482
	$\frac{\Delta t}{C}$	0.01191	0.03655

Interpolations

From Table 4	From Table 6
$\frac{0.01191 - 0.008}{0.012 - 0.008} \times 127 = 124$	$\frac{0.03655 - 0.036}{0.040 - 0.036} \times 120 = 16.5$
$k = 0.7560 + 0.0124 = 0.7684$	$k = 0.6795 + 0.0016 = 0.6811$

		0.7684	0.6811
Increase in center distance	$\Delta C = \Delta t/k$	0.2324	0.8049
Increased center distance	$C + \Delta C$	15.232	15.805

Table 8—CALCULATION OF PINIONS WITH ONE-TOOTH ENLARGEMENT

Standard pressure angle	ϕ	= 20 deg.
Number of teeth	N	= 19
Standard center distance	C	= 19.000 in.
Increased center distance	C_1	= 20.000 in.
Increase in center distance	ΔC	= 1.000 in.
	$\frac{\Delta C}{C}$	= 0.05263

Interpolation in Table 1:

$$\frac{0.05263 - 0.050}{0.055 - 0.050} \times 102 = 48$$

$0.8464 + 0.0048 = 0.8512$

	k	= 0.8512
Increase in thickness (two pinions)	$\Delta t = k\,\Delta C$	= 0.8512 in.
Circular pitch	p	= 3.1416 in
Standard circular thickness	t	= 1.5708 in
Increase in thickness (one pinion)	Δt_1	= 0.4256 in.
Increased circular thickness at standard pitch diameter of 19.000 in.	t_1	= 1.9964 in.

Radar Now Made Public

A once closely guarded secret, the powerful electronic "eye" called radar, is now described by many of the companies which contributed to its development and manufacture. This useful instrument of war uses a high-frequency radio echo to determine the presence and location of unseen objects in space. The radar system does the following: (1) It generates high-frequency, high-power electrical waves; (2) it projects these waves from an antenna; (3) it picks up the waves which reflect back from the object in its range; and (4) converts these into a pattern on a fluorescent screen.

Radar types are broadly classified in two categories: First, the "search" type which sweeps wide and distant areas to detect the approximate position of a target. Second, the "fire control" type which uses a narrow beam to determine precisely the position of the target so that shells can be properly aimed.

Associated with these equipments are electrical circuits which accurately time the echoes from the unseen objects and measure the distance and give the exact position. Other circuits enable the reflector-like antenna to follow the enemy object automatically as it moves.

Radar is credited with an important roll in enabling the Allies to stand off the aggressor nations during the early years of the war and to turn the tide against them. An early radar of the long-range search type enabled R.A.F. airmen to save Britain from the Nazi air blitz.

Taper Turning Beyond Graduations On Standard Bench Lathe Compound

Angular and cylindrical cuts taken in continued operation by using cross-slide to turn taper and compound-slide for cylindrical portion of work

BY FRITZ L. KELLER

TAPER TURNING beyond the compound graduations available on a standard bench lathe frequently presents difficulties. In some cases, where the compound has been set beyond the 50 or 60 deg. normally available, the ballcranks of the cross-slide and the compound-slide interfere with each other. For angles beyond compound graduations the cross-slide can be used for turning the taper and the compound-slide for cylindrical turning.

The cross-slide can be set to the required angle by a protractor and a parallel, as in Fig. 2, by a micrometer or a feeler gage or by using a test indicator, as in Fig. 1. When using a protractor it is advisable to use a parallel that fits into the lathe bed slot upon which the protractor is held. The cross-slide is then set to the angle indicated by the protractor. When a micrometer is used the compound is first set to the required angle and the cross-slide set over until the compound-slide runs parallel with the lathe bed. The latter procedure applies to checking by means of a test indicator.

For the final inspection, an indicator checks the compound movement against a cylindrical part of the work as shown in Fig. 1. This is a quick and accurate method of setting an angle beyond the reach of the compound, and a cylindrical portion and taper can be turned in one operation, the cross-slide being used for setting the angle

In machining a part having a taper of 10 deg., or 80 deg. off the axis, as in Fig. 2, the compound is set 10 deg. closer to the cross-slide, or 80 deg.

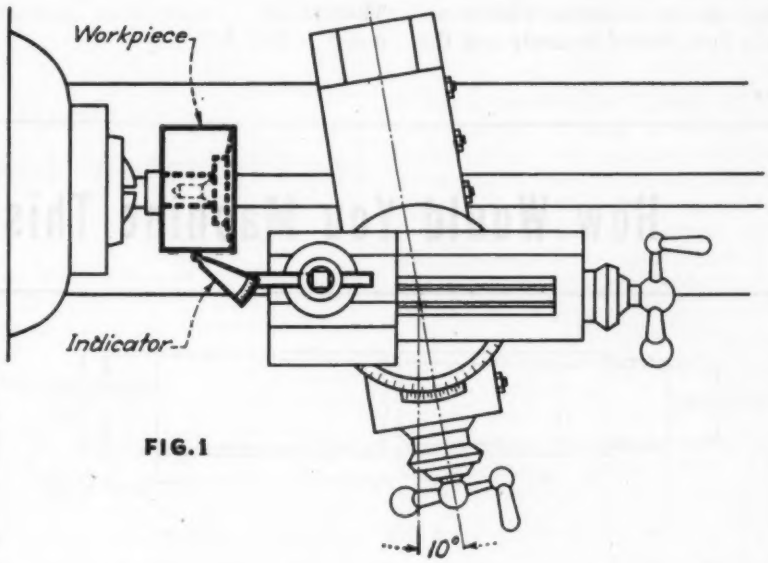


FIG. 1

Fig. 1—An accurate check on cross-slide setting is obtained by placing an indicator in the toolbit holder and running it over the cylindrical portion of the work

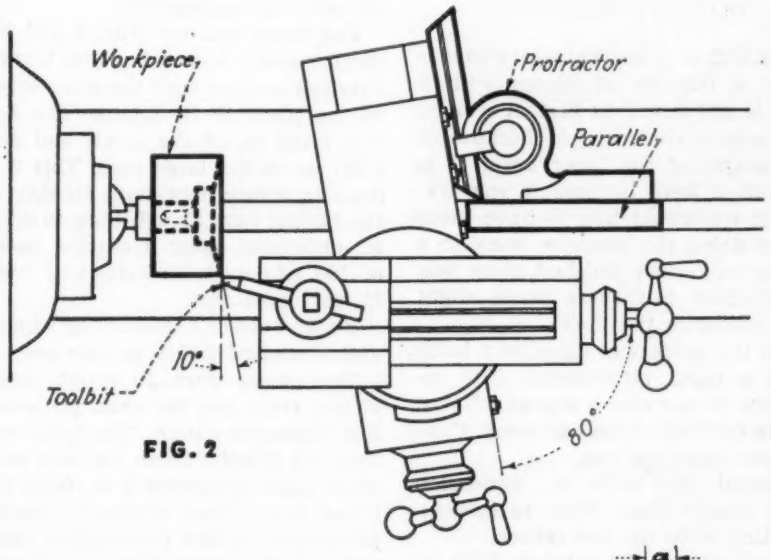


FIG. 2

Fig. 2—The cross-slide is set to the required angle by means of a protractor and a parallel which fits into the slot of the lathe bed

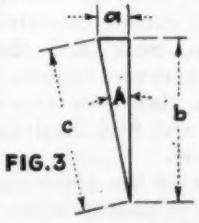


FIG. 3

Fig. 3—The difference between the depth of cut and cross-slide movement increases as the angle A is increased

away from the lathe bed. The locknut holding the cross-slide to the lathe bed is then loosened and the cross-slide is set over until the compound is parallel with the lathe bed. The cross-slide is tightened enough to allow the indicator to be fastened in place of the toolbit and an accurate check made by running the indicator over the cylindrical portion of the work. Any inaccuracy can be corrected by moving the cross-slide an appropriate distance. The cross-slide is then locked securely and the indicator replaced with a toolbit.

To find the cross-slide movement required to remove 0.100 in. from the diameter of the piece, refer to Fig. 3 where

a = Forward movement of the tool while using the cross-slide at an angle.

b = Depth of cut, equal to half the distance of the diameter before and after the cut is taken.

c = Cross-slide movement.

Then

$a = b \times \tan A$

$b = \dfrac{\text{dia. before cut} - \text{dia. after cut}}{2}$

$c = b \times \sec A$

Hence

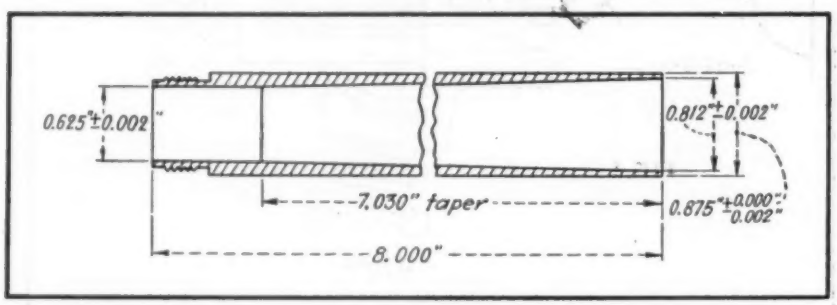
$a = \dfrac{0.100}{2} \times \tan 10 \text{ deg.} = 0.0088 \text{ in.}$

$b = \dfrac{0.100}{2} = 0.050 \text{ in.}$

$c = 0.050 \times \sec 10 \text{ deg.} = 0.05077 \text{ ins.}$

It is evident that there is little difference between the depth of cut and cross-slide movement at an angle of 10 deg. This difference is increased as the angle is increased.

How Would You Machine This Long Taper?



A long unsupported bar boring a tapered hole caused excessive chatter at high cutting speeds; low speeds and fine feeds produced a better finish but required two hours for the cut, but chatter marks were not so pronounced

BY DAVID T. ARMSTRONG

RECENTLY, it was necessary to machine a number of pieces with a long inside taper. At first, it seemed like a very difficult job, because of the length of the taper bore. It is submitted here because it was unusual; we would like to have ideas about doing the machine work in a better way. The finished piece was satisfactory but there were slight tool marks in the bore.

All the work was done on a lathe with a taper attachment. The sequence of operations was as follows:

Use 0.937 in. brass bar stock. Center and face one end.

Layout the 8.000 in. dimension with height gage. Face to line indicating 8.000 in. and center.

Turn outside diameter to 0.875 in.

Turn, neck and shoulder with piece between centers.

In a three-jaw chuck drill with ¼, ½ and 9/16 in. drills to a depth of 4½ in.

Reverse the piece and repeat the above sequence until the hole is through. It was found that the drills did not walk appreciably.

The taper was set with a dial indicator and a boring bar was turned between centers with the same taper as the piece to be bored. The bar was 0.500 in. at the small end and 0.687 in. at the large end. This was done to insure maximum rigidity of the boring bar. Rough bore to 0.010 in. undersize using a cutting speed of 100 s.f.p.m. with a feed of 0.005 in. per revolution.

Finish bore at a speed of 10 s.f.p.m. and a feed of 0.0015 in. per rev.

The pieces were all rough bored at one time and the ends projected 3 in. from the chuck. The lathe was then set for the finish cut and each piece again projected 3 in. from the chuck jaws. Thus, without changing the setting on the micrometer reading of the cross-slide, all pieces could be bored alike. For the finish cut it was necessary to indicate each piece.

The boring operation required 2 hr. to travel the 7 in. on the finish cut. Every speed and feed of which the lathe was capable was tried for the finish cut and it was found that a cutting speed of about 10 s.f.p.m. and a feed of 0.0015 in. per revolution was the only speed and feed which would give an acceptable finish. Most of the objection was against the excessive chatter, but there appeared to be no way to avoid it. The piece was held in a three-jaw chuck and steady seated without any improvement in the finish, with the final decision that the 8-in. overhang of the boring bar caused the chatter and the situation could not be improved. This conclusion was arrived at when it was demonstrated that it was possible to use a cutting speed of 120 s.f.p.m. with a feed of 0.0015 in. per revolution and obtain a good finish provided you wrapped your fist about the boring bar and steadied it. However, as the overhang increased as the boring bar made its way deeper into the hole, the chatter became objectionable.

The pieces were checked with a truncated taper plug gage and the tool marks were estimated to be 0.002 in. deep.

At one stage of planning, the making of a two-fluted taper reamer was contemplated, the cutting edges to be staggered to overlap by 1/32 in. because it was thought such a tool would give a fine finish. However, the cost of making such a tool for a small run was not warranted.

Because the tool is fed into the work at an angle, the cutting end of the boring bar cannot be supported from the spindle. The diameter of the hole is too small to make a self-adjusting boring tool.

Does any reader have a better method?

Practical Ideas

HAVE YOU A PRACTICAL IDEA?... If so, send it in. Your idea will help other men, in other shops, who have a problem similar to yours. We pay for acceptable contributions prepared exclusively for this publication

Progressive Punching Tools Avoid Material Loss

BY H. R. HAGEMAN

When narrow strips of sheet metal are required with a tolerance so close that neither commerical flat wire nor the product of the conventional parting die are satisfactory, they are often produced with a common push through blanking die. This method is wasteful in any case. To prevent troublesome curling of the scrap caused by the shear on either the punch or die, it may be necessary to increase the width of the bridging between the blanks, causing a loss of almost 50 percent in scrap.

The principal objections to the common type of parting die are as follows. It is difficult to obtain stock sheared to exact width, necessitating the addition of notching or trimming punches. If the die is designed without a pressure pad the edges of the blanks will be somewhat beveled, but if a pressure pad is added then the blanks must be ejected from the die, which is not always as simple as it may appear.

To overcome the foregoing difficulties, a progressive punch and die was designed. The plan of the tool is shown. The die can be made in sections.

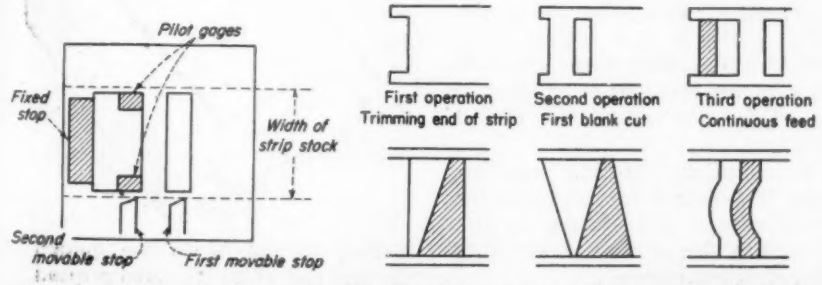
The strip stock is a trifle wider than the blank, to provide marginal strips to carry the unsevered blank along.

Strip stock enters from the right. The leading edge is trued by advancing it to the first movable stop, where the blanking punch partly trims the end of the strip stock of what will be the second blank when it is later severed from the marginal scrap, pushing the scrap through the first blank opening in the die.

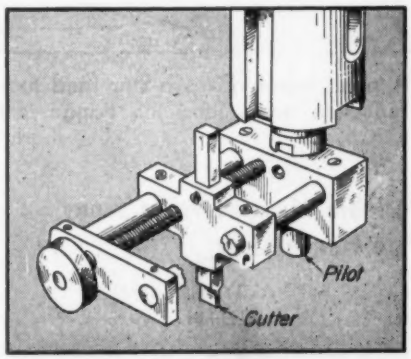
Next, the stock is advanced the width of two blanks to the second movable stop where it is accurately located in position by two pilot type gages carried by the punch holder. Tripping the press at this point forces the first blank through the first die opening, leaving the second blank attached to the marginal strips. Again advancing the strip stock the width of two blanks, or until it reaches the fixed stop, the second blank lies over a double width die opening where the second blank is separated from the marginal scrap while at the same time another blank is pushed through at the first station. After this operation, the stock is fed continuously without operating any stops, making two blanks at each stroke of the press. Only two narrow marginal strips, each a trifle wider than the thickness of the stock, are scrap.

The reason for the double width die opening is to allow room for the blank to fall through and permit space for the pilot type gages which hold the strip in position by passing through the space formerly occupied by the first blank.

This type of blanking tool can be used for numerous symmetrical or reversible shapes. For small work, there need be no shear on the punch or die.



The plan of the die shows the first movable stop and the severing die hole, the second movable stop with the pilot gages from the punchholder going through the double width hole in the die and the fixed stop



By using the knob on the adjusting screw, holes can be cut to close tolerance; the pilot locates the center of the hole and assists in preventing vibration

Adjustable Fly-Cutter Increases Accuracy and Stops Chatter

BY R. ERICKSON

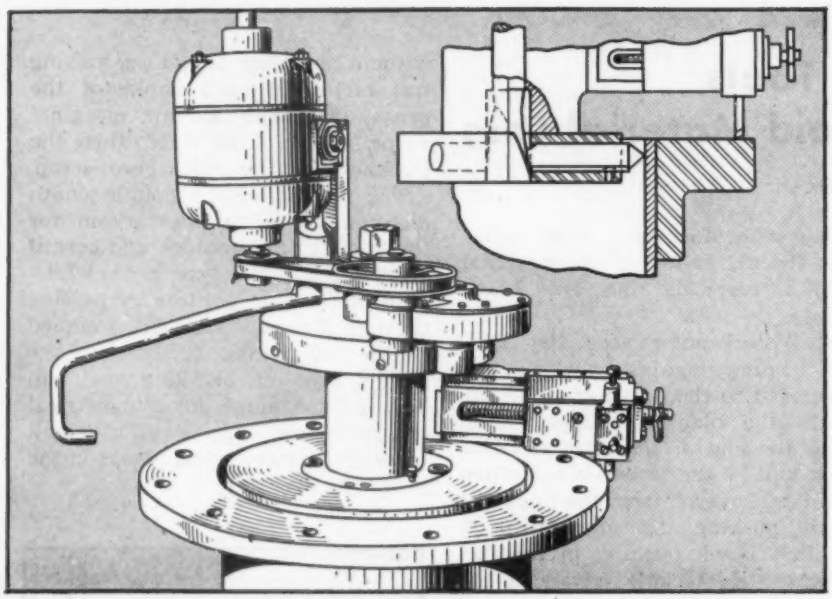
Douglas Aircraft Company, Inc., Chicago Plant, Park Ridge, Ill.

Customarily, fly-cutters are makeshift affairs, rather frail and not capable of turning out work rapidly or very accurately. To support the tool rigidly and prevent chatter, a toolholder has been made which can be attached to the drill spindle.

This toolholder consists of a steel

block with a shank fitting into the drill spindle; on the botton is a pilot to locate the center of the hole to be cut: at the side are two bars upon which the toolholder slides. The toolholder, is tapped for an adjusting screw and is arranged to hold a tool-bit firmly. By use of the adjusting screw with a knob, the cutting tool can be set quickly to cut holes to exactly the size desired by user.

With this substantial fly-cutter assembly, the setting is exact and the tool rigidly held in position, so cutting speeds can be high and work turned out in short order. The man-hours saved are appreciable each month. *Suggestion from the Board for Individual Awards, War Production Drive.*



A small motor drives a star feed tool carriage by means of a V-belt and reduction gears, and the flange is faced to close tolerances in a very short time

Portable Machine Faces Many Pipe Flange Sizes

BY HARRY HOLMAN
Toolmaker, Yarrows Limited, Victoria, B. C.

For accurate and quick facing of pipe flanges, there has been developed a machine which can be mounted in position without much effort.

The machine fits on the flange face, is aligned for square or bias cut by removable plates which fit the size of pipe to be faced. A taper bar, passing through the center of the removable plate and machine, actuates three dogs or pins which grip the interior of the pipe and hold the flange facer immovably in position. These dogs are located in holes extending to the edge of the removable plate.

The facing tool is a fly cutter mounted in a holder capable of be-moved across the area by a star wheel attached to the feed screw and actuated by a bent bar fastened to the stationary part of the machine. For small flanges, the toolholder is fastened to the slide at the four holes closest to the center, the larger flanges require the toolholder to be at the outer position. The whole assembly is driven by a ¼ hp. motor through a V-belt drive and reduction gears.

Two sizes of this machine are in general use. These accommodate pipe sizes ranging from 4 to 7 in. and 7 to 22 in. A similar machine has been used to face gun rings with an overall diameter of 66 in. A special job was the truing of a crankshaft coupling face while it was in place; this was completed to very close tolerances and passed inspection.

The simplicity of the machine makes it possible for an operator (in our case, a girl) to set up and face a 12 in. flange in approximately 30 minutes total time.

This machine can be set to cut surfaces at angles to fit misaligned joints or offset fittings.

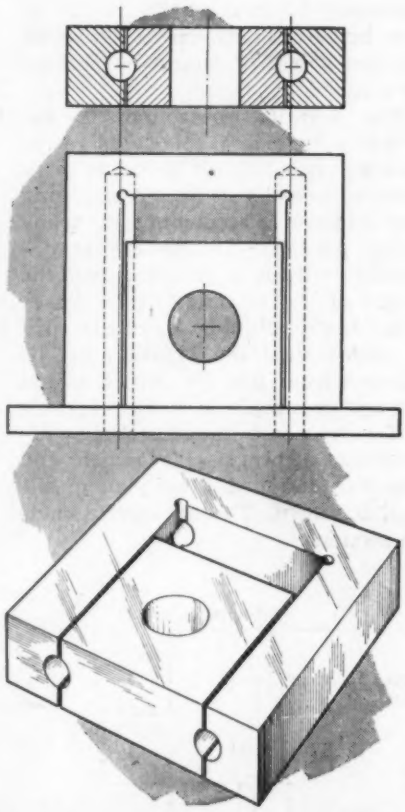
Round Guides Replace V-Ways for Sliding Journal Boxes

BY WM. OWEN JONES

To avoid machining V-ways and fitting a journal box to slide on them, another method was tried which was quicker and more economical.

Because a bearing is necessary, a block of steel was drilled from one edge almost through, after which these holes were reamed smooth, then a slitting saw made cuts ⅛ in. off center of the holes toward the journal center, these saw cuts were parallel to the hole centers. The journal box was severed from the guide block and machined to correct length and bored, no other machine work being necessary.

Two pieces of drill rod were pressed into the reamed holes in the guide block and these formed the guiding surfaces. Because the guide block and the journal box were drilled and reamed together, no fitting is necessary.



Sliding journal boxes are guided by drill rod which has been pressed into drilled and reamed holes. This method reduces machining to a minimum and fitting is not required

Milling Machine Heads Used for Cutting Caulking Bevels

BY PERRY JUDKINS
The Permanente Metals Corporation
Shipyard Number One, Richmond, Calif.

With the purpose of making a tight joint between plates and the edges of the legs of a heavy angle, it was the custom to chip the rounded edge of the legs with a cold chisel and hammer, or burn them with a torch.

Due to the small amount of metal that could be removed without unduly narrowing the legs of the angle, the resulting chipped edges were comparatively ragged and good chippers were scarce; burned edges were not conducive to a good caulk.

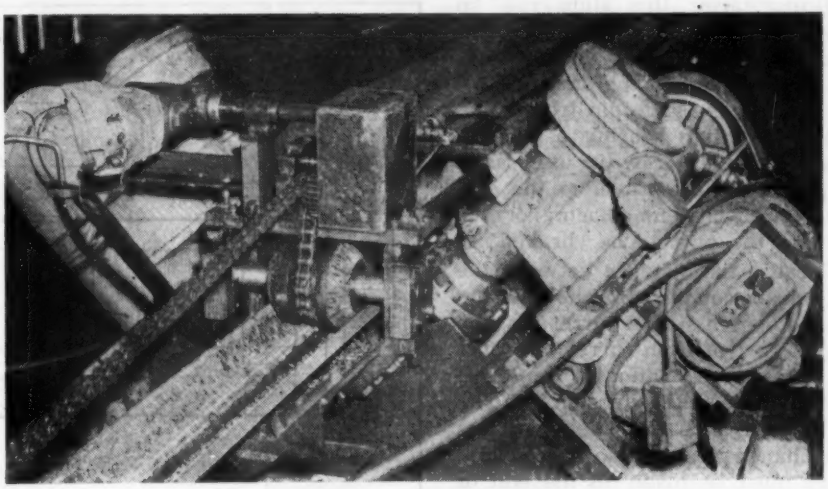
This disadvantage was overcome by making a machine composed of two portable milling heads mounted on bases which support them at an angle of 45 deg. to the horizontal so that the cutters can take a good cut off the toe of each leg of the angle.

The angle is supported by beveled rollers in such a way that the legs are 45 deg. to the horizontal. Double-bevelled knurled rollers fit inside the angle and provide enough pressure to feed the angle toward the cutters. The feed drive is powered by a variable-speed air motor which is geared down and on the low speed shaft is a sprocket. A sprocket is also used between the double bevelled rollers; a roller chain connects these sprockets and powers the angle drive.

Coolant flows from a separate motor driven pump; excess fluid flows to a sump and is recirculated to the cutters.

Angles whose toes have been machined have uniformly sharp edges and caulking these edges provided absolutely tight joints along the entire length of the angle assembly.

The result of this installation was greater safety, increased production, an improved product and an economy of time and labor in the plant. *Suggestion from the Board for Individual Awards. War Production Drive.*



Use of milling cutters to produce a uniform edge for caulking the toes of angles resulted in tight joint at a saving in cost

Thickness Between Counterbored Holes Checked With Turret Gage

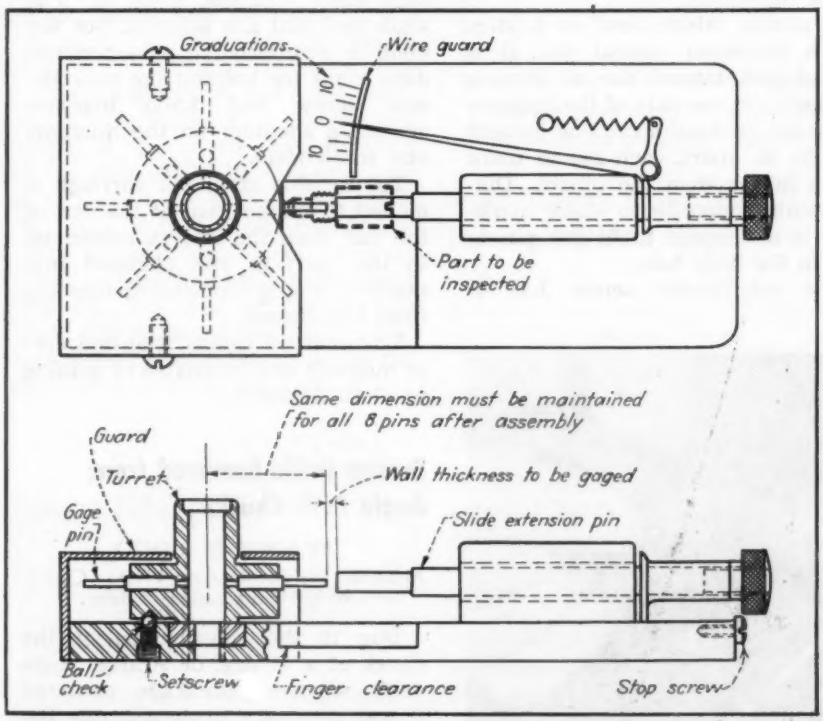
BY BERT BROWNE

A turret-type multiple indicator gage was developed by the Carter Carburetor Corporation for checking the wall thickness between counterbored holes in opposite ends of small parts in which the wall thickness must be the same regardless of the size of the counterbore.

The part to be checked is placed on a slide extension pin and then pushed on a gage pin of the proper size mounted in the turret. Each turret position is located by a ball check held in a detent hole by a compression spring.

The turret has a knurled knob so that it can be turned easily with the fingers. Each of the gage pins is press fitted into the turret body. The outer end of each of these pins is turned to the required diameter, concentric with the body diameter, and is held to within plus or minus 0.0002 in. limits.

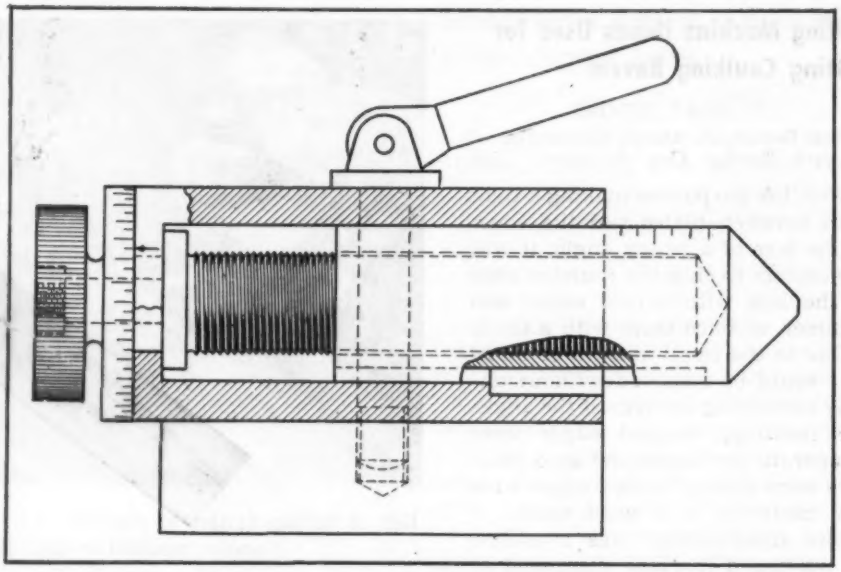
The slide extension pin is the same diameter for all the parts to be gaged, it fits into the large counterbored hole in the part to be inspected. On the outer end of the slide pin is a knob with a shoulder which contacts the knife edge of the



The distance between the end of the slide extension pin and each of the turret pins is constant, any variation is shown by the indicator

indicator arm; this slide can be moved easily with the fingers into and out of gaging position. The bearing for the slide pin is bronze bushed. To prevent the slide pin from being pulled out of its bearing, a fillister-head machine screw is used as a stop to limit the travel to the distance necessary for placing or removing the part to be checked.

Because the distance between the bottoms of counterbored holes is the same for each size of turret pin, the gaging end of each turret pin must be in the same relation, within close limits, of the slide extension pin. The end of the slide extension pin does not change position, so the adjustment must be made on the end of the turret pin. This is obtained by building-up gage blocks to the desired thickness then honing the end of each turret pin in turn until the indicator reads zero. To preserve this accuracy over a long period of time, all gage pins must be hardened to a minimum of 63 Rockwell C.



A hardened conical stop can be moved along the bed for rough adjustment; the final adjustment is made by using the micrometer dial

Micrometric Lathe Stop for Close Tolerance Work

BY GEORGE HOLMAN

The customary carriage stop is fastened to the front V on the lathe bed at a position convenient for the carriage, then the stop screw is set by the trial and error method.

To prevent loss of material and time, a micrometer stop has been made which can be graduated to 0.001 in. for final adjustment, but can be clamped to the lathe bed at any position.

A body is made of cast iron or steel machined to fit the shear and side of the bed. A hole is bored to take the graduated and tapped piston, and a pin or key projects through the bottom to act as a guide for the piston. A hole is drilled through from the top for the clamping screw. The clamp is a flat plate machined to fit the underside of the way, but it is tapped for the clamping bolt. The clamping bolt passes through the body, its lower end is threaded into the clamp but its upper end is fitted to a cam lever for quick tightening.

A piston, which acts as a stop, has a hardened conical tip. It is drilled and tapped for 40 threads per inch. On one side of the cylinder there are graduations of one fortieth (0.025) in. apart, each fourth mark being longer than the others. Diametrically opposite to these markings is a keyway to fit the pin or key in the body hole.

The micrometer screw has 40 threads per inch to fit into the piston, it is long enough to take the full travel of the piston and still have a few threads in contact. The other end of the screw is shouldered to take the thrust in one direction. The stem of this screw passes through a hole in the body of the stop and is threaded at its end.

The knob on the micrometer has a dial graduated with 25 spaces, each space equaling 0.001 in. The knob and dial are integral, but the knob is counterbored to accommodate a nut for holding the micrometer screw and knob together against a shoulder on the micrometer screw stem.

To use this stop, the carriage is moved to the position at the end of the cut, then the stop is moved up to the carriage and clamped into position; the micrometer makes the final adjustment.

This method avoids trial and error methods and is capable of holding to close dimensions.

A small nut on the threaded shank of a drill prevents breakage inside the chuck; the portion beyond the chuck, after the nut has been removed, is long enough for pliers to grip and make removal easy

Broken Drills Removed from Angle Drill Chucks

BY LOUIS DI RIENZO

Airplane Division-Kenmore Plant Curtiss-Wright Corporation, Buffalo

Due to the construction of the chuck of a 45 deg. or 90 deg. angle drill, whenver breakage occurred it was necessary to disassemble the entire chuck to get at the stub within, because the breakage took place

either at the surface of the chuck or slightly inside.

By screwing a No. 5-40 hexagonal nut on the threaded shank of a No. 41 drill before placing it in the chuck, breakage occurred either at the surface of the nut or slightly inside. Removing the part in the chuck required backing off the nut and using pliers to turn out the part inside. The nut may be ruined, but replacement cost is slight.

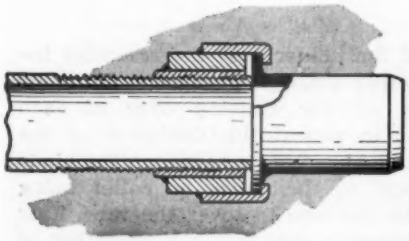
As a result of this expedient, the only additional cost, necessary when a drill must be replaced, is the inexpensive nut. The labor saved in removing the thousands of drills that break each year has been entirely eliminated. Repairs are reduced to a very low point, it is no longer necessary to dismantle the chuck, and it is working a longer time. *Suggestion from the Board for Individual Awards, War Production Drive.*

Pipe Chuck Adaptor for Machining Lapped-Joint Stub Ends

BY FRED HAGER
Oregon Shipbuilding Corporation

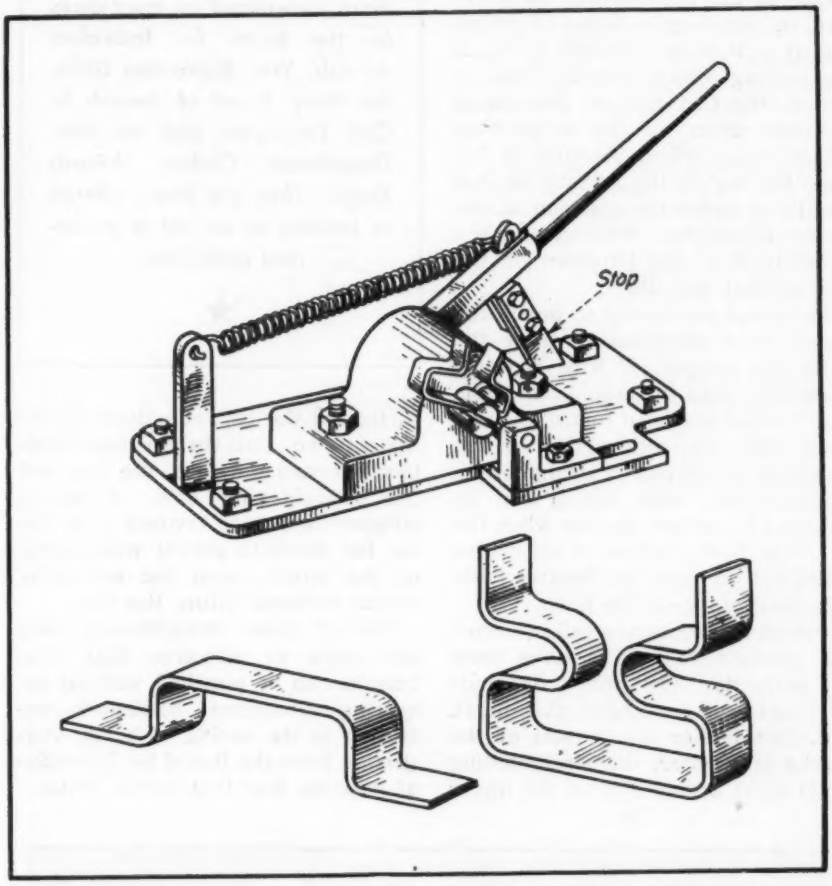
Lapped-joint stub ends are machined to a bevel before they are welded to a length of pipe. Due to their shape, they are not easily set up in a pipe cutting-off machine, because the outside diameter of the flange is too large for the chuck jaws.

This disadvantage has been overcome by chucking a convenient length of pipe of the same diameter as the stub end, then cutting a long thread on it. A pipe coupling has two dogs welded diametrically opposite to each other, but with enough space between the end of the coupling and the jaws of the dogs to allow the flange of the stub end to pass easily; this sleeve is run on the piece of pipe held in the chuck.



A coupling with welded dogs holds lapped-joint stub ends in position when a threaded nipple is jammed against the flanged end

To machine the edge of the lapped-joint stub end, the flanged end is placed between the coupling dogs and the coupling is turned until the free end of the piece of pipe in the chuck jams against the flanged end of the stub end firmly, after which beveling or facing can be done easily with accuracy and at a saving of time. *Suggestion from the Board for Individual Awards, War Production Drive.*



A slotted shaft holds flat bar steel while it is being bent against a roller; the amount of bend is controlled by a stop bearing against the lever

Strap Bending Fixture for Forming Intricate Shapes

BY H. J. MEYER
Bethlehem Steel Company, San Francisco Shipbuilding Division

A useful bench fixture has been made to form strap-iron hangers for pipe and electric cable.

The fixture consists of a base which can be fastened to a work bench; a bearing is attached to this base as is also an adjustable bracket. Through the bearing is a shaft, one end of which has a slot large enough to take the strap iron, the other end is fastened to a long lever; a spring supports the lever when it is not in use. To obtain the correct bend in the strap iron, an adjustable stop is provided to check the rotary movement of the slotted shaft; the adjustable roller bracket takes care of different thicknesses.

To make the bend, a piece of strap iron is placed in the slot and the lever pulled down. The metal is jammed between the slotted shaft and the adjustable roller and bends as the lever is pulled down until the stop prevents further movement. Some overtravel is necessary to take care of spring back of the metal. Bends of very small radii can be formed with ease. The limiting distance between bends is the thickness of metal between one side of the slot and the outside diameter of the shaft.

This bench former has tripled production over hand bending with a hammer, and a 15 percent saving in material has resulted. *Suggestion from the Board for Individual Awards, War Production Drive.*

Thin Bar Stock Straightened by Punch Press Holdown

BY ALFRED YOUNGBLOOD
Oregon Shipbuilding Corporation

One of the peculiarities encountered in punching a series of holes, one at a time in flat bar stock, is the curling which results. This is due to the fact that as the punch descends upon the bar a peening action occurs when pressure is put upon the metal, the surface against the die is under compression as the punch penetrates. This causes the metal to flow and lengthen on the side against the die.

The usual practice is to punch the metal, then straighten it after the holes are completed. This requires more time than the actual punching.

A method has been found to overcome this. On either side of the punch there are placed straightening or stabilizing bolts which can be adjusted to contact the bar when the punch is at the bottom of its stroke, a locknut on each bolt assures positive positioning of the bolt.

Action takes place as follows, once the straightening bolts have been set correctly. The punch descends as usual and penetrates the metal, but, just before the bottom of the stroke is reached, the straightening bolts exert pressure upon the upper surface of the bar, effectively pushing it down until there is solid contact between die face, the bar and the straightening bolt. A spring stripper is also in contact with the flat bar stock to permit withdrawal of the punch upon the ascending stroke without lifting the flat.

Use of these straightening bolts has been so effective that long lengths can be punched without requiring subsequent handwork, resulting in the saving of labor. *Suggestion from the Board for Individual Awards, War Production Drive.*

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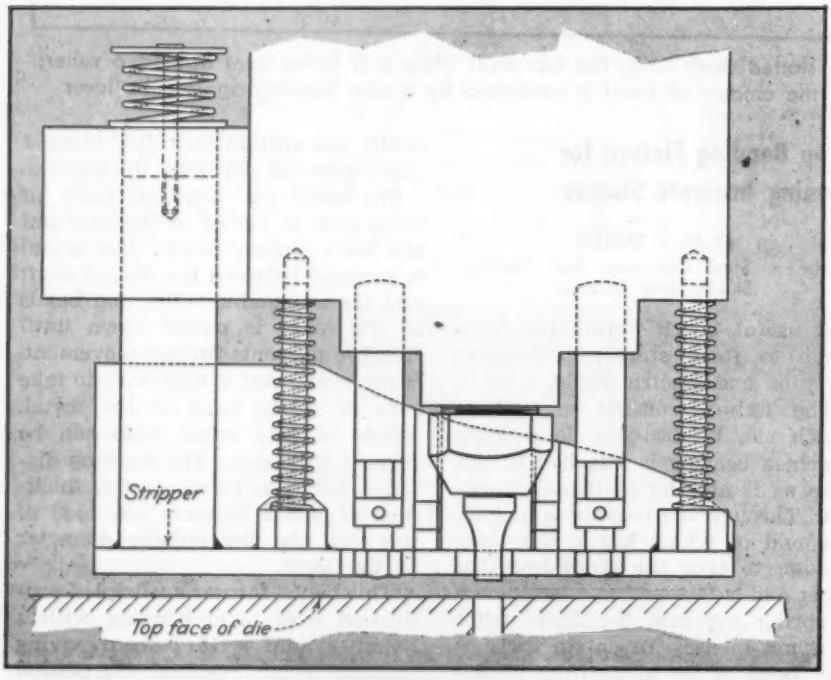


Straightening bolts produce a counterbending which straightens the curvature caused by punching and results in a straight product

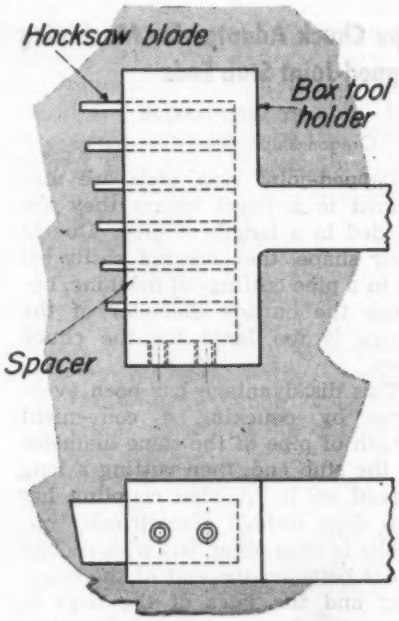
Multiple Cutting-off Tool for Producing Spacer Tubes

BY MICHAEL AXLER

Large numbers of brass tube spacers were required and every effort must be made to conserve material, labor and increase production. The usual cutting-off blade is about 3/32 in. thick, which means a large amount of wasted metal for production. Hacksaw blades are about 0.025 in. thick, resulting in a saving of 0.068 in. per cut. With this in mind, old hacksaw blades were used as the cutting-off tools.

To expedite manufacture, steel block spacers of the correct thickness and a boxtool to hold the blades and spacers were made. After the spacers and properly ground hacksaw cut-off blades were assembled in the holder, setscrews in the end of the holder held the assembly together rigidly. Care must be taken to set the cuttting edge of each blade almost the thickness of the tube ahead of its neighbor, the blade next to the chuck or collet being the last one to sever the tube. This assembly resulted in high output at a distinct saving of metal.

This method utilizes broken hacksaw blades which are scrap and takes advantage of their thinness.



Thin hacksaw blades used as cutting off tools save material for high-production work

Selection Guide for Electrodes—III

E6011 electrodes will comply with the requirements of the codes and specifications numbered from 3 to 11 inclusive under E6010 electrode, except that in item 6, Grade 3 is substituted for Grade 1.

E6012 Electrode

The E6012 type of electrode is characterized by medium penetration, a rather quiet type of arc, slight spatter, and dense slag completely covering the deposit. The covering is high in titania, usually exceeding 35 percent by weight, which accounts for its usually being referred to as the titania or rutile type. In addition, the covering usually contains various silicious materials such as feldspar and clay, small amounts of cellulose, ferromanganese and sodium silicate as a binder. Also, small amounts of calcium compounds may be used to produce satisfactory arc characteristics on straight polarity. The core wire is identical with that used on E6010 and E6011 type electrodes. Whereas single pass welds may meet radiographic requirements, multipass welds fall far short.

Generally speaking, fillet welds tend to be convex in profile, having a smooth even ripple in the horizontal position and a widely spaced convex ripple in the verical position which becomes smoother and more uniform as the size of the weld is increased. Ordinarily a larger size fillet must be made in the vertical and overhead positions than with E6010 and E6011 electrodes of the same diameter, if good fusion and profile are to be obtained.

It is recommended for vertical and overhead work where more ductile weld metal is considered unnecessary although such use is generally confined to electrodes 3/16 in. in diameter and smaller. It is specifically recommended for single-pass horizontal fillet welds where weld metal quality permits, due to the ease of handling, good weld profile and ability to withstand high welding currents. It is probably the most satisfactory type for work involving poor fit-up. Wide gaps can be bridged quite readily.

This electrode has been used to advantage on many low-alloy steels, particularly of the higher carbon varieties. This is probably due to the fact that the penetration obtained, although adequate, is by no means the equal of that obtained with the E6010 or E6011 types. As a result, the pickup of alloying ingredients is not as great, which undoubtedly has a beneficial effect from the standpoint of cracking. When used in the vertical and overhead position, current values nearer the lower end of the range should be employed.

Electrode Diameter, in.	Current, amp.	Voltage, arc volts
1/16	20 to 40	17 to 20
5/64	30 to 80	17 to 21
3/32	80 to 130	18 to 22
7/64	120 to 180	18 to 22
1/8	140 to 250	20 to 24
9/64	170 to 300	20 to 24
5/32	200 to 400	20 to 24
3/16	250 to 500	22 to 26
7/32	300 to 600	22 to 26

The weld metal deposited by this electrode is lower in ductility and higher in yield strength and tensile strength than weld metal from either E6010 or E6011 electrodes.

	As Welded	Stress-Relieved
Tensile strength, psi.	62,000 to 78,000	60,000 to 75,000
Yield strength, psi	52,000 to 65,000	50,000 to 60,000
Elongation in 2 in., per cent	17 to 22	22 to 67
Reduction of area, min., per cent	25	30
Impact resistance, ft-lb., izod	25 to 50	
Endurance limit, psi	not determined	
Density, g. per cu. cm	7.80 to 7.85	
Brinell hardness	150 to 170	

The chemistry of the deposited metal does not vary greatly from that obtained from the E6010 or E6011 types. However, microscopic examination will disclose the fact that the weld metal contains far more nonmetallic inclusions.

The E6012 electrode will comply with the following codes and specifications:

1. U. S. Army Specification No. 57-203, Type 1, Class B.
2. Army-Navy Aeronautical Specification, AN-E-9, Class A.
3. American Bureau of Shipping (with certain exceptions).
4. A.S.M.E. Code for Unfired Pressure Vessels, Paragraphs U-69 and U-70.
5. Lloyd's Register of Shipping, Section 4, Paragraphs 1 to 8, inclusive.
6. U. S. Coast Guard (with certain exceptions).
7. British Corporation Register of Shipping and Aircraft.
8. Building Codes of New York City and Pittsburgh and other Municipalities.

E6013 Electrode

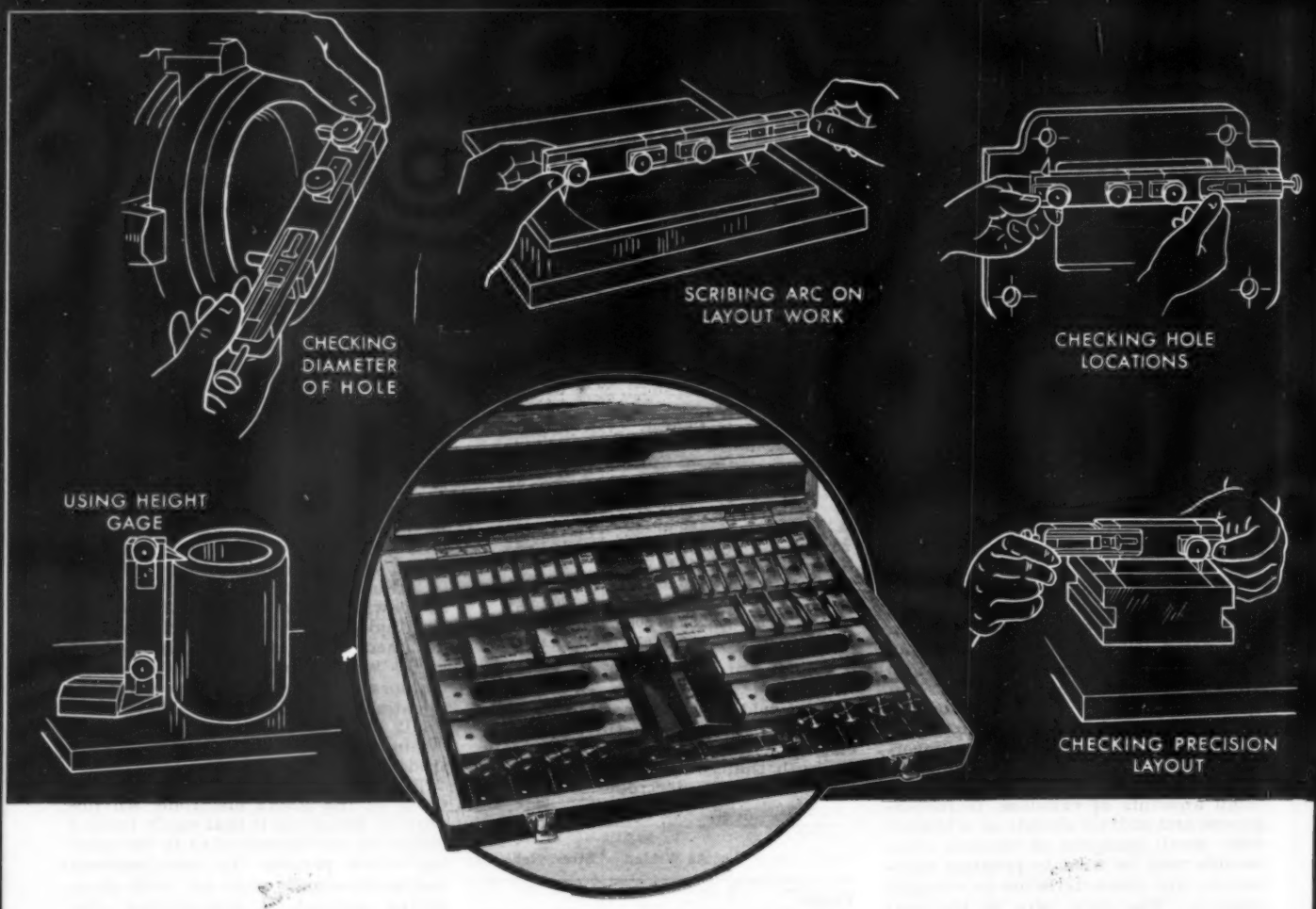
The E6013 type of electrode, although similar to the E6012, possesses worthwhile differences. Slag removal small diameters (1/16, 5/64, and 3/32 is somewhat better and the arc can be established and maintained more readily, particularly in the case of the small diameters (1-16, 5-64, and 3-32 in.) thus permitting satisfactory operation with lower open circuit voltage. Originally this type of electrode was designed specifically for light sheet metal work. However, the larger diameters are being used on many applications previously welded with E6012 electrode. Even less penetration is obtained than with the E6012 electrode.

The coverings used are similar to those of the E6012 electrode. An important difference is that easily ionized materials are incorporated in the coating which permits the establishment and maintenance of an arc with alternating current at low-welding currents and low open-circuit voltages.

It is very similar to the E6012 type in operation and appearance of deposit when used in an identical manner. The arc action tends to be quieter and the deposits more polished in appearance. It is generally recommended for sheet metal applications where its ability to weld satisfactorily in the vertical position from the top down without leaving surface holes is an advantage. Because of unsatisfactory performance on galvanized plate and decidedly less penetration, this electrode is unsatisfactory.

	As Welded	Stress Relieved
Tensile strength, psi.	62,000 to 72,000	60,000 to 70,000
Yield strength, psi	52,000 to 58,000	50,000 to 56,000
Elongation in 2 in., per cent	17 to 22	22 to 27
Reduction of area, min., per cent	25	30
Impact resistance, ft-lb., izod	not determined	
Endurance limit, psi	not determined	
Density, g. per cu. cm	7.80 to 7.85	
Brinell hardness	140 to 160	

Ordinarily the high welding currents possible with the E6012 electrode cannot be used. When welding in the vertical and overhead positions, however, the current and voltage will be very similar. The usual recommended values of current and voltage for the various diameters that are available are given in the following table:



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The Webber Heavy Duty set also brings to the shop a more useful tool for the layout and inspection of all precision shop work.

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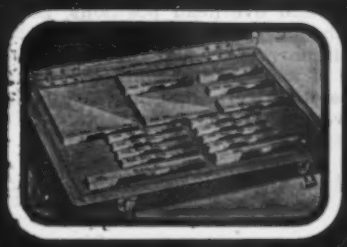

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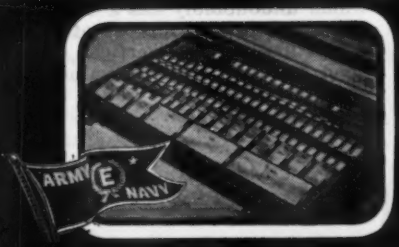

Selection Guide for Electrodes—IV

Electrode Diameter, in.	Current, amp.	Voltage, arc volts
1/16	20 to 40	17 to 20
5/64	30 to 80	17 to 21
3/32	70 to 120	18 to 22
7/64	120 to 170	18 to 22
1/8	140 to 240	20 to 24
9/64	170 to 300	21 to 25
5/32	200 to 350	22 to 26
3/16	250 to 450	23 to 27
7/32	300 to 500	23 to 28

The chemistry of the deposited metal is very similar to that obtained from the E6012 type. However, the weld metal is definitely less dirty from the standpoint of slag and oxide inclusions.

E6013 electrodes will comply with same codes and specifications given for E6012 electrode, *except* U. S. Army Specification No. 57-203 Type I, Class B.

E6020 Electrode

The E6020 type of electrode is designed to produce flat or slightly concave horizontal fillets with either a.c. or d.c., straight polarity and will produce satisfactory results on fillets and groove welds in the flat position with a.c. or d.c., either or both polarities depending upon the brand. It is characterized by a spray-type arc and a heavy slag, well honeycombed on the under side, which completely covers the deposit and can be readily removed.

When normal welding currents and technique are employed, penetration is medium. However, it is capable of operating satisfactory at high currents which results in deep penetration particularly when such a technique is employed as in deep fillet welding. Of all the types of electrodes produced this is generally considered the best for this specialized procedure.

This is essentially a mineral-covered electrode. Slag coverage is so extensive and the slag metal reactions are of such a nature that the electrode does not normally depend on gaseous protection. In most cases the core wire employed is the usual 0.10 to 0.14 per cent carbon steel.

Fillet welds tend to have a flat or concave profile and a smooth, even ripple. In many cases the surface of the deposit is dimpled. It is to be expected in practically all cases on the first few passes of deep groove welds. As the weld nears completion this tendency decreases. Many have noted the fact that the use of alternating current tends to promote this dimpled condition to a greater extent than does direct current. No undesirable mechanical or physical defects are associated with this surface condition.

Generally speaking, this electrode is recommended for horizontal fillet welds where the best quality is desired and where rigid radiographic examination must be met. High deposition rates can be obtained with high quality on flat fillet and groove welds in heavy plate. This type of electrode is not generally used on thin sections due to increased warpage resulting from the higher currents usually employed.

Applications include pressure vessels, heavy machine bases and structural parts, where thickness of section permits.

The following table of currents and voltages which follows may not apply to every brand. Obviously, when making horizontal fillet welds using the conventional technique, current values nearer the lower end of the range should be employed if undercutting is to be held to a minimum. If the deep fillet welding technique is employed, the higher currents are used.

Electrode Diameter, in.	Current, amp.	Voltage, arc volts
1/16	100 to 140	24 to 28
5/64	120 to 180	26 to 30
3/32	175 to 250	30 to 36
7/64	200 to 325	30 to 36
1/8	250 to 400	30 to 36
5/32	350 to 450	32 to 38
3/16	400 to 550	34 to 40

The range of mechanical properties to be expected from the weld metal when deposited in accordance with the test procedures prescribed in the specifications are shown in the following table:

	As Welded	Stress-Relieved
Tensile strength, psi.	62,000 to 68,000	60,000 to 66,000
Yield strength, psi	52,000 to 58,000	47,000 to 53,000
Elongation in 2 in., per cent	25 to 30	30 to 36
Reduction of area, min., per cent	40	50
Impact resistance, ft-lb. izod	50 to 70	
Endurance limit, psi	30,000 to 34,000	
Density, g. per cu. cm	7.82 to 7.86	
Brinell hardness	150 to 170	

E6020 electrodes will comply with the codes and specifications listed as items 3, 4, 5, 7, 8, 9, 10 and 11 under E6010 and the following: U. S. Army Specification No. 57-203, Type I, Class C, and Navy Dept., Bureau of Ships Specification 46E3(INT) Grade II, Classes 2 and 3.

E6030 Electrode

Any electrode designed to fulfill the requirements of the E6020 classification will also fulfill the requirements of the E6030 type, which has been designed primarily for use in narrow groove welds.

The slag produced is usually less dense but just as easily removed as that from the E6020 type. When using direct current, best results are usually obtained with reversed polarity. Generally speaking, the E6030 type of electrode is capable of showing higher deposition rates than the E6020 type.

The coverings employed are similar to those of the E6020 type. In most cases the core wire employed is the usual 0.10 to 0.14 per cent carbon steel.

Each layer of fillet or groove welds has a concave profile and a smooth even ripple. The tendency for the surface of the deposit to be dimpled is not as pronounced as is the case with the E6020 type.

This type of electrode is recommended for welding heavy plate in the flat position only. Applications include pressure vessels, heavy machine bases and structural parts where the thickness of the section permits. Of these, probably the greatest tonnage is used in the construction of pressure vessels where narrow deep grooves are the rule.

Currents and voltages found satisfactory for most brands available are identical with those for E6020 electrode.

The range of mechanical properties to be expected from the deposited metal when deposited in accordance with the test procedures prescribed in the specifications is identical with those expected of the E6020 class. Likewise, the chemistry of the deposited metal is very similar, if not identical. This electrode, like the E6020, is especially useful where rigid radiographic examination must be met.

E6030 electrodes will comply with the codes and specifications listed as 3, 4, 5, 7, 8, 9, 10 and 11 under E6010 and also Navy Dept., Bureau of Ships Specification 46E3 (INT) Grade II, Class 3.

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Gaging Business

Tool Builders Reconvert

Reports from leading tool builders indicate that they have taken heavy VJ cancellations in stride and are now proceeding with long-laid postwar plans. Despite the wiping out from builders' backlogs of some $70,000,000 in tool orders in August (about $30,000,000 in military business and $40,000,000 in Russian lend-lease orders), many companies were working hard to meet the requirements of the automobile and other reconverting industries. Moreover, several firms announced their entry into new fields and the availability of new and better equipment.

Warner & Swasey, well-known lathe builder, is entering the textile machinery field, which is said to have many years of peak potential orders in sight, and is also offering a new line of tools for handling brass plumbing fixtures with electric controls at each station. The company stated it was diversifying its activities as a safeguard against tool business fluctuations and against sales of government surplus tools.

New Business Looms

The industry is greatly heartened by the fact that the railroads have again become active buyers, after some 20 years' limited purchases in the tool market. Moreover, the plastic industry is becoming quite a factor in its demand for presses and molding machines.

Leading builders have begun plans to exploit the promising Latin-American tool market, spurred on by reports that Sweden had already become an active factor there. Moreover, the industry has been surprised, pleasantly, to find South African businessmen here actively seeking equipment. It had been expected that South African purchases might have been pretty well corralled by British equipment makers, who had been reported taking French orders some time ago. However, South Africans here say that the British are in no position to handle foreign orders in many types of equipment. They say that Britain will have its hands full returning its industry to normalcy, and that its equipment builders have been unable to make reasonable delivery promises on many items.

South Africa has high regard for American-made equipment, and is prepared to pay cash for its purchases. This factor tends to alleviate the uncertainty surrounding lend-lease orders recently placed by France and Belgium under special arrangements made after the end of the European War. Some observers believe that other financing of such orders will be arranged.

Pressure Eased

With about four months' business on its books, the industry is better able to handle its orders. All regulations are off the industry now, except for "AAA" ratings for remaining military orders, and a "MM" rating band for emergency orders. However, WPB's Tools Division is giving special assistance to reconverting companies tied up by lack of a few tools.

Indications are that some requirements are now being filled from surplus items and some cancellations are stemming from that factor. In July, $3,133,000 worth of unrated orders were cancelled, probably for this reason. That was about one-fourth of July's total cancellations, which amounted to $12,783,000, slightly higher than June's $11,977,000. New orders are being curtailed for this same reason, with July's total new business coming to $28,271,000, down 19 percent from June's $35,092,000. July's shipments were hampered by confusion over Russian lend-lease orders, foundry bottlenecks, and the Fourth of July holiday. That was why shipments for that month were around $32,521,000, as against June's more normal shipment's of $41,040,000.

The industry's backlog at the end of July was $240,335,000, before the heavy August cancellations came in.

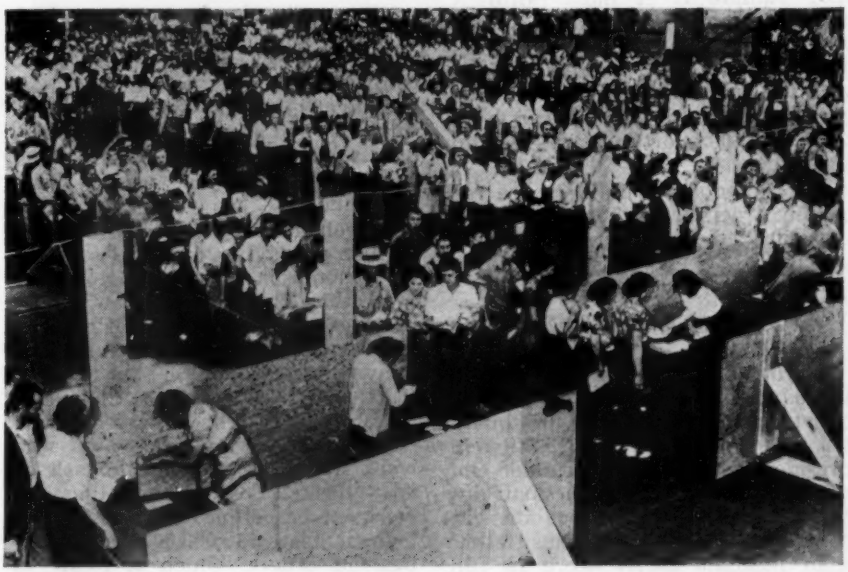
Getting Surplus Faster

Plants desiring to buy surplus equipment, and able to justify the fact that inability to secure such items is holding down their employment, will be given special assistance by the government to get what they want. Such cases are regarded as emergencies, and needed tools will be made available as promptly as possible. Moreover, price negotiations are postponed in these cases until after delivery of the tools. Manufacturers can aid the speed of such transactions by locating what they want themselves. Sometimes such items have been located by prospective buyers before they had been declared surplus to RFC.

War Work Continuing

As sharp as cutbacks have been thus far, some war work is still going on in various plants around the country. As a result, it is reported that the Air Forces will taper off their acceptances to about 3800 planes for the remainder of the year.

The Ford V-12 tank engine contract has been reinstated, and it is believed that this output will be for replacement purposes. The huge Detroit Tank Arsenal will continue to make tanks and parts for the army, as well as trucks. This arsenal will become a permanent peacetime installation for the Army.



VJ Lay-offs Hit Plane Workers—Typical of the large-scale dismissals of aircraft industry workers after the Jap surrender is this group of some of the 11,900 employees of the Long Beach Douglas Aircraft Company shown lined up for their final pay checks

Tool Builders, Other Cleveland Firms, Report Good Prospects

Spot checks indicate confident plans; backlogs assure good rate of sustained operations. Railroads and plastics industry are active equipment buyers

CLEVELAND—A check with leading Cleveland concerns reveals a highly optimistic attitude toward immediate industrial prospects. This includes several leading machine tool builders, who have just sustained cancellations of Russian and military orders, but have sufficient civilian orders for machine tools or new types of business to maintain full operations.

Besides being able to turn their attention to automobile industry reconversion orders, tool manufacturers are cheered by the renewed activity of the railroads in the machine tool market. For the past several months, the Chesapeake & Ohio, Nickel Plate, Wheeling & Lake Erie, and Pere Marquette, have been buying machine tools—in fact, the Nickel Plate has practically completed a $300,000 buying program, having placed an average of $50,000 worth of orders monthly for the past six months. Although C & O has ordered only a small amount of equipment thus far, indications are that the bulk of its ordering is ahead.

Rail Inquiries

Several other large rails have been making inquiries. This is not so surprising to tool builders, even though the railroads have been a minor factor in the tool market for the past 20 years. The reason is that the shop equipment of most railroads includes many antiquated units, which they have been unable to replace due to lack of funds. Now, with the financial position of all rails greatly improved, they appear to be taking this opportunity to reequip their shops.

Some equipment builders are receiving orders from the up and coming plastics industry, and heavy purchases of presses and molding machines are expected eventually.

Tool Builders Optimistic

Warner & Swasey expect to build twice as many tools in the fourth quarter as they did in the first quarter of 1945. Charles J. Stilwell, president, stated that the sudden end of the war would cause a small delay for reconversion, since its war contracts (including items other than machine tools) were in full force until they were all cancelled. However, over half of the company's V-J backlog was for peacetime operations. In addition, the company will add several new machine tool lines, including one designed for handling brass plumbing fixtures with electric controls for each turret station. The controls change speeds, direction of rotation, and can index the work within 10 to 20 degrees, when tapping or threading, so that the thread start can be indexed relative to the work.

National Tool Company recalled 375 of its 434 wartime employees to their job to work on auto industry orders. Officials admitted that prospects were dark for the first few days after August 14th. Then with the air cleared and mail bringing in sizable orders, the outlook brightened so that today there are sufficient orders booked for full scale operation for several months.

National Acme's president, F. C. Chapin, says that the company has sufficient civilian orders for machine tools to keep the plant busy a year. All of the company's war orders had been filled weeks before the Jap surrender. It anticipates a postwar volume 25 percent above prewar.

(From Cincinnati comes word from American Tool Works that it has a "comfortable" backlog of peacetime orders. No cut has been made in work schedules, and officials say they see no reason for a cut in the immediate future.)

Other Industry Reports

Other Cleveland concerns had even more glowing reports. Most outstanding was the one from Lincoln Electric Co., which has had no layoffs, needs 300 additional workers, and is operating on a 50-hour week basis. The company plans to give its employees a 15 percent wage increase.

Cleveland Welding plans to begin civilian production of bicycles shortly. Thompson Products expect to more than double their prewar employment, and reach a total of over 8,000 employees. White Motor Company plans to double its prewar truck and bus output. Cleveland Graphite Bronze had to lay off 2,000 of its 6,500 workers, when its war work was cancelled, due to lack of enough facilities to keep them at work on peacetime products. However, it has a $15,000,000 backlog in bearing orders, which it plans to turn out at a $2,000,000-monthly rate, and is spending $4,000,000 for new equipment to handle this bearings business, and other work.

The Lamson & Sessions Company faces no reconversion problems, and the company is still in need of new workers, according to vice-president J. F. Donahue. Addressograph-Multigraph has been working on peacetime products since June, and is continuing full employment of its workers. Eaton Manufacturing estimates that its postwar employees will be double the prewar total.

Cancelled Russian Lend-Lease Tool Orders Stir Most Comment

CLEVELAND—Despite the cancellations of many American tool orders, the cut which caused the most comment and confusion was the elimination of the high-priority Russian lend-lease orders, totaling about $40,000,000. This was the unfilled balance of an original $120,000,000 Russian program.

The Russian cancellation order to Cleveland firms came within a week after August 14th, leaving some manufacturers, whose shops were glutted with Russian-bound tools in various stages of completion, in a difficult spot for reconversion. This ended one of the most unusual batches of orders ever placed in the hands of the tool industry.

Early in 1945, the Russians were slow to order the tools they said they badly needed, and some tool builders contended that the Russians were more interested in trying to beat down prices than in getting quick deliveries. Meanwhile, a new flood of military orders pushed back Russian deliveries, and slow progress was made until June, when $11,000,000 in such business was shipped. Then, manufacturers were ordered to hold up further shipments to the Soviet, since the war with Germany was over and it was not at war with Japan. This did not apply to orders for shipment via Pacific ports.

During this holdup period, Amtorg representatives tried to place private orders on a cash or credit basis, asking for terms which had never before been encountered by the industry. Many companies refused to sign these Russian-made 10-page contracts, leaving the Russians to complain to Washington over their inability to buy.

In the midst of this, Russia entered the war and machine tool builders were ordered to furnish such tools as would be required to help defeat Japan.

Although Russia is still a large potential market for American machine tools, judging from the attitude of Cleveland tool builders, the Soviet will have to seek less exacting terms to make its purchases here.

Detroit Letter

Reconversion Progressing

The automotive capital has taken on a familiar look. The mountains of wires, carrying cancellations for war orders, have been neatly filed away and have been replaced by daily reports on reconversion progress. The great hum of war production is now less than a murmur but the murmur is becoming louder as the production lines are renewed.

Soon assembly lines will begin to groan again. A few are now in operation but move at a snail's pace. By the end of this month, the pace will be greatly accelerated in most of the auto factories and by the end of October, normalcy will once again be restored.

Meanwhile, about a quarter of a million are out of jobs temporarily. Most of them are eligible for compensation and have applied.

Upswing Started

The upswing has started but slowly. Until the removal of the quotas from car production and some light on prices, the manufacturers appeared not too eager to swing back into peacetime output. But with all restrictions off on output and the pricing formula offering a chance to go back into business with a profit, they are heading back into familiar lines with zest.

Public Showings Soon

Ford is already under way. Only the hazy price situation and some troubles with materials kept output at low ebb at Rouge. The price formula they now have, and the company will now start to get a few cars to each of their dealers. They will have a public showing of the new models in late September, and then will announce prices. The rest of the producers will no doubt keep their prices dark until the Ford list is out.

Oldsmobile is also making a few cars and expect now to turn to in earnest. Hudson brought their first pilot model off last week and only awaits a clearing of the materials situation to get into volume output.

Nash has shown its new lines to dealers privately and in 30 to 45 days expects to be sending quite a few down the assembly lines. By December it expects to reach near pre-war levels and by next spring, it will attain its post-war aim of a 250,000-car rate, triple normal output.

Most of the General Motors divisions will be in production either late in September or early October. Little is being said in the corporation on its plans but reconversion is proceeding as quickly as possible. Because of some continuing war contracts, GM officials have been in huddles for more than a week to clear decks for cars without letting up for the government.

Chrysler Coming In

Chrysler is even more mysterious about its plans. It too has some contracts which have to this date not been cancelled in full. Plymouth is being pushed as fast as possible to get to the starting line with Ford and Chevrolet.

Packard, once the hardest pushed of all the auto factories because of its tremendous war commitments, is being cleared rapidly. It began setting up a parts line some time ago and by filling it in now, the company will be ready to start producing in October.

Parts Difficulties

Materials are beginning to flow in goodly quantities but components are slow. Some of the suppliers are slow in getting back into step and may cause a little delay to the manufacturers. Strikes at the plants of some suppliers have also caused hold-ups.

One encouraging factor, however, is the removal of price ceilings on parts. Some suppliers have been refusing or holding off orders until OPA settled its policy on this. Now with the ceilings off, it will be the familiar hard bargaining, with the car makers fighting to keep prices down within the formula set as their ceiling.

Both Chevrolet and Fisher Body officials are silent on the report that the former plans to make their own bodies for the new low-priced vehicle, announced recently by General Motors. Chevrolet plans to build the bodys in Cleveland, as well as the whole car.

Some guessing is being made on this innovation. It may mean an entirely new body construction, of the integral type with the frame of steel tubing.

Willow Run Sale Doubted

The Kaiser-Frazer deal for Willow Run is being greeted with derision and snickers. Joseph W. Frazer, the Detroit end of the team, confirmed the announcement on the coast by Senator Homer Ferguson that the new corporation's bid was in for the bomber plant.

It was pointed out by an observer of the industry that in the last year that Graham made passenger cars, it had not only enough room in its own plant for its own cars but rented space in its factory to outsiders.

"So what would they do with a mile-long assembly line?" he asked. And others echoed the thought.

Washing Machines In Large-scale Production—Assembly line production of washing machines is now under way at the reconverted plant of the Hurley Machine Co., Cicero, Illinois. This is only one of the plants that have accomplished rapid change-over from war production

Steel Sheet Prospects Improved With VJ Confusion Untangled

PITTSBURGH—Except for galvanized sheets, bottlenecked by heavy orders, it now seems probable that steel mills during the rest of the year will be able to supply the sheets needed for actual peacetime operation. This is the aftermath of the ironing out of the initial confusion following VJ cancellations, shifting of former priority orders, and the lack of specifications on unrated orders. Such uncertainties caused irregular operation for the first two weeks after the Jap surrender when cancellations were being ironed out and customers were hastening in their specifications. For the present, uncancelled rated orders are given priority positions on mill schedules.

Those finished steel products readily usable in peacetime production have been affected least by recent industry unsettlement. Tin-plate, pipe and wire have maintained a generally satisfactory position on mill schedules. Although cancellations for steel bomb tubes had come in slowly, pipe mills are now back at work on oil country goods.

On the other hand, no steel plate was made in the Pittsburgh district for two weeks after the Jap surrender. There were substantial orders for plate, including a large aggregate tonnage for railroad equipment, but it was felt that the jam in peacetime steel orders could be straightened out more advantageously and quickly if main efforts were applied in that direction. Thus, in two weeks the shape situation was thoroughly "cleaned up", and it was possible to move ahead in turning out this type of steel according to need and specifications.

Flat-rolled Schedule Job

The task of reforming schedules in sheets and strip has been an enormous one with progress uneven. Cold-rolled sheets have been less affected by cancellations than hot-rolled but in some cases a shortage of trained workers is delaying production and shipment of cold-rolled sheets.

Steel managements have been keeping their eyes on labor developments, since they knew it would not be easy to change from an overtime basis to a standard 40-hour week. The CIO has gone on record for more "take home" pay and its slogan is "profitable occupation at high wages." The transition to the 40-hour week has been sudden and it remains to be seen whether time will not modify some of the workers' demands. Much will depend upon the course of prices which will affect the cost of living. In the meantime, sporadic strikes within the industry have continued, yet there has been an easing in one sector which had been a sore spot—the captive coal mines.

One opportunity that the industry may have to offset changing profit margin due to the different "product mix" is a possible weakening in scrap prices, especially alloy steel scrap.

WARNER & SWASEY MAKES TEXTILE MACHINERY

CLEVELAND—As part of a long-term diversification program, Warner & Swasey is entering the textile machinery field. In making the announcement, Charles J. Stilwell, president, said that the program was planned not merely to utilize expanded facilities, but to protect the company against the fluctuation of the machine tool industry, and against sales of government surplus tools.

Production of a knitting machine and an improved type of gill box for use in the woolen industry is planned in the near future, and other types of textile equipment are under consideration. The company also plans to develop products in several other industrial equipment fields, but in all cases its activities will be confined to capital goods and equipment.

Officials of the company deny that any arrangements have been made with the Sulzer Brothers, Switzerland, to build their famous shuttleless loom, although some discussions have been carried on between both firms.

Warner & Swasey has built a new gill box for the Uxbridge Worsted Company, but some further changes will be made in it before its operation. It has several entirely new features.

Surplus Law Changes Looming

WASHINGTON—Surplus war property policy, soon to be revised by Congress, will affect the country for many years to come. Actual disposal of surplus may continue through two decades, as it did following the last war, which was a miniature by comparison.

Last fortnight the Surplus Property Board, following expressions by President Truman, asked the House Committee on Executive Expenditures for legislation substituting a surplus property administrator for the present three-man board. The single administrator is wanted, by the President and apparently by most other interested parties, for quicker decisions and action than can be given by the three-man board.

DETROIT TANK ARSENAL MADE PERMANENT UNIT

DETROIT—The huge Detroit tank arsenal in Centerline, operated for four years by Chrysler Corp., and which supplied 25,000 tanks from the M-3 to the M-26, 40-tonner, will continue as a permanent installation, according to Brig. Gen. W. P. Boatwright, head of the office, Chief of Ordnance Detroit. It will not only make tanks and parts for the Army, but also make trucks.

Retention of the tank arsenal will add the second permanent government installation to the Detroit area. The Naval Arsenal at Centerline, once operated by Hudson and now under Westinghouse management, will be retained by the government.

While the industrial operations division of the Detroit office will be cut down to a peacetime basis, the field service section, in charge of stock control, maintenance, storage and redistribution, will be retained in full force. The field service staff consists of 292 officers and 292 civilians. Of the 184 officers and the 1,300 civilains in industrial operations, 65 officers and 421 civilians will be retained.

Chrysler is turning back the arsenal to the Army immediately. It is also returning to Packard, the Proving Grounds at Utica, used to test tanks.

Brig. Gen. Boatwright is retiring from the Army, after 37 years service. He has been in charge of the Detroit office since July, 1943. His successor has not yet been named.

While excess war property piles up in staggering quantities, the Board says that disposal is being hampered by "social and economic objectives" of the Administration and its statutes. This means chiefly the question: whether to sell the goods now, while the price and the demand are good, or throttle disposal in the interest of manufacturers.

Disposal in July totaled $41,920,000, a realization of 32% on cost of the property. The sales were somewhat less than in June, because, the Board's Regulation No. 2, giving a 30-day option to federal, state and local governments, went into effect.

Three billions dollars in surplus property was released by the Army from the start of war to July 31, half of it in three months of German defeat. Of the three billions released before VJ, two billions was in airplanes, mostly useless except for scrap. One of the largest items declared since German collapse was 36,238 used trucks costing $50,000,000, mostly two tons and under.

Washington Bulletin

Hunting For Surpluses

Persons wanting to buy or lease government-owned machine tools will do well to make inquiries on their own. It is not possible for RFC, or the Army, or the Navy, or any government agency to know how many machines it has in various types, or where all of them are. Procurement was mostly authorized by regional agency offices. There is no kind of bookkeeping that could keep track of deliveries and transfers and break them down into government-owned - and - operated, government owned-and-leased, scrambled-facilities, etc., and show up reliable surplus item catalogs and totals in Washington. Point is that if inquiry of RFC doesn't locate what's wanted the customer should go scouting on his own.

Jobs Spur Action

The capital is extremely sensitive on employment. The No. 1 priority now is on jobs. If any agency fails to deliver action for quick employment, the politicians will soon put the screws on it. The agency bosses are actually shortcutting routine and red tape more for conversion than they did for some war emergencies. Veteran bureaucrafts were surprised at the speed with which WPB and other controls were unhitched from industry. Elimination of priorities and controlled materials and allotments by September 1, with a few exceptions, was snappy work compared with Washington's usual ponderous movements.

But the employment motive is making trouble for the Office of Price Administration. OPA demands that manufacturers of hard goods, and their distributors, absorb most of their price increases resulting from increased costs. Producers and tradesmen reply that their profit incentive is being destroyed and that they cannot expand and hire unless allowed to raise prices. The outcome of this contention will markedly affect the demand for metal working machinery and other production equipment. Labor and consumers want low prices for automobiles and other durable goods. In the case of automobiles, Walter P. Reuther, UAW-CIO vice president, condemns OPA for relaxing control over automobile prices, and says he believes OPA will fail to maintain 1942 levels.

Lend-Lease Unsettled

Figures being quoted on the volume and value of lend-lease machine tool orders suspended by termination of the program can be only rough estimates at best. Lend-lease headquarters here know the total allocations to various countries, and they have various breakdowns. But they don't have adequate industrial classifications, and specifically they do not have machine tools. Even before the cancellation of lend-lease, there were many transfers of goods from one country to another, so that an inventory on any one of them was difficult. Since cancellation, it takes a lot of checking to determine what goods were in transit. The President's cancellation order gives recipients the privilege of accepting further orders, for cash, and it will be months before such continued deliveries can be audited.

Small Firms Aided

Efforts by the government to help small operators into business, including OPA's small-volume pricing program, may succeed, and if so it will attract some inexperienced managements, staffed by many ex-service men, in many fields. Newcomers will include firms that will require all kinds of special attention and assistance on the part of manufacturers' representatives. Some of this sales effort will be wasted, because some of the new customers will be early casualties in the competitive struggle. On the other hand, many of them will be fortified with smart, energetic and determined executives who will lay the foundations for successful enterprises.

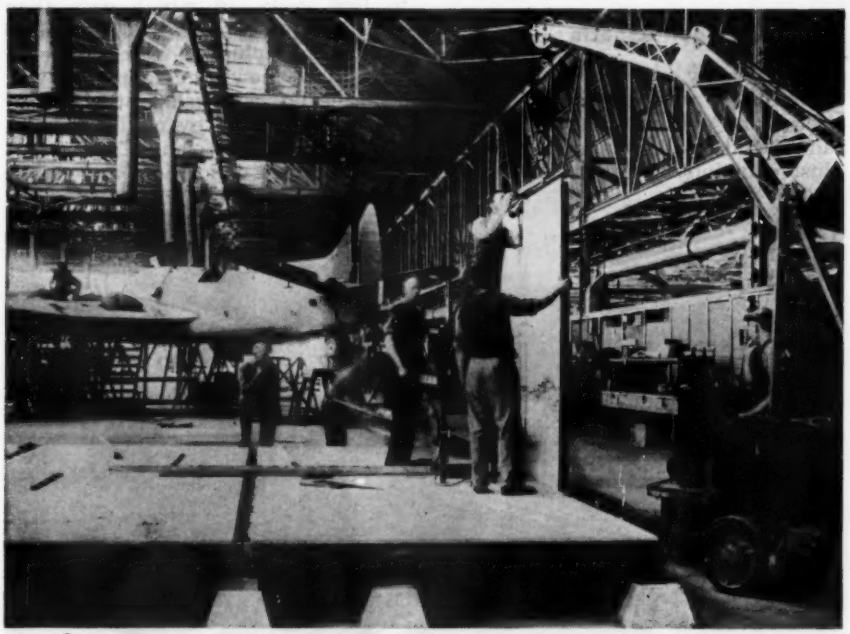
Japanese Market

Attitude of Japanese leaders in their defeat is attracting comment here. Again and again Jap officials express desire that their country abandon its bellicose program and seek to build up its technology and its industry. When war anger dies down, as it will, Japan may reveal more admiration for its American conquerors than for other peoples, and will again be a major customer for industrial and consumers' goods, and Germany will be out of competition. It will be up to Americans to get in and beat the English to the Japan markets.

Security Lid On

Persons who think the security lid is clear off are mistaken. Key to continued restrictions is forthcoming determination by Congress of the size and composition of the U. S. military defense forces. The military wants to keep all of its advantageous secrets not revealed to the enemy in war.

Certain items of metallurgy in jet turbine rotors, discoveries in internal aerodynamics, chemical warfare, ordnance—are not discussed in detail. Top item of course is atomic energy, which may yet yield large advantage to American industry.



English Reconversion From Planes To Prefabricated Houses—The end of the war and the housing shortage has given a big boost to prefabricated housing in Great Britain, and helped this plane plant into logical reconversion. The Bristol Aeroplane Company is making units, constructed largely of aluminum alloy, consisting of two bedrooms, hall, living room, kitchen, and bathroom within a single story. Target is 1,200 houses per month

Spotting the Air News

Plane Output Tapering

Cutback aircraft schedules are subject to revision, but present indications are that Army Air Forces will accept about 3800 planes during the rest of this year. Navy's production program for 1945 was not ready at this writing but its peacetime air strength was estimated by Secretary Forrestal at 8000 planes. Military aircraft deliveries may taper to a very small rate before Congress decides on peacetime strength of the Army and Navy, after which deliveries might be increased. Total air power of 20,000 planes has been frequently suggested, and the Aircraft Industries Association (old Aeronautical Chamber of Commerce) would have the government replace 25% of its air equipment each year.

In general it is expected that military orders on hand, plus new research and development project orders on hand and expected, will occupy the home plants of most aircraft manufacturers almost to capacity for an indefinite period. The industry is placing its chief argument and hope for sustaining Government business in a continuous technical development program. Considering the fabulous pay-off of technical superiority in the war, public opinion is likely to support it.

Service Merger Aspects

Controversy over unification of the Army and Navy is boiling up as expected and many military and civilian officials will demand that conclusive action be taken before the final decision by Congress on the size and character of peacetime U. S. armed forces. The Army and Army Air Forces, generally speaking, are for the merger, while Navy and Marines are against it. But individual opinion differs through all services. Defeat of Japan without invasion, mostly through damage inflicted by the air arms will give aviation the predominant voice in reorganization of the armed forces. The old debate about a separate air force is increasingly academic as inseparability of air and surface action becomes more obvious. The time may come when surface forces may hesitate to mention the matter, for fear they themselves will become subordinate to air.

Surplus Transports

For air transport the war's end means early unlimited allocation of surplus transport planes. Over 10,000 4-engined DC-4 types and over 1000 2-engined DC-3 types were built for military service. But the operators will not long be satisfied with these old designs. They will begin taking deliveries on new Douglas, Lockheed, Martin, Boeing, Curtiss-Wright and other transports early next year. The trunk lines may expand 300 percent within three to five years, in which case they would require around 2000 to 3000 airplanes—including foreign services. Two new developments will come early: establishment of feeder lines everywhere, by public demand despite Post Office and Civil Aeronautics Board opposition; and establishment of pick-up air mail services for almost all post offices. These two systems will require a smaller type of airplane, in much larger numbers.

Heavy Private Plane Needs

For private flying the future is uncertain. Most authorities feel that a market comparable with that for cars is in the cards, but they can't guess when. The big drive for it has already begun. The government's airport program, together with thousands of small fields to be built privately, will help. But planes depending on airports will not sell in millions. Tremendous design effort is being concentrated on rotary wings and roadable designs to solve the problem. In any case the minimum future market probably will be six or eight times the maximum pre-war market, which was 6000 units a year.

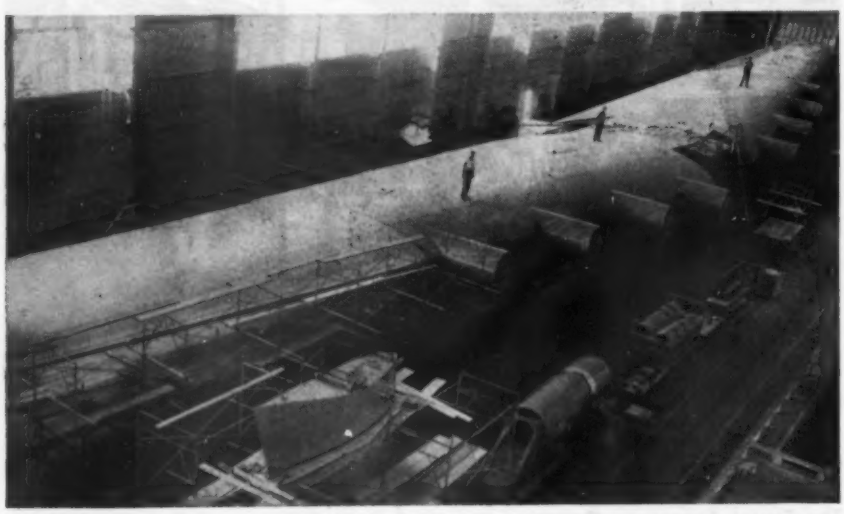
Surplus Engine Problems

More serious by far to manufacturers than the airframe war surplus is the aircraft engine surplus. One unofficial estimate places the number of new engines in pipelines between factories and warfronts on V-J day at about 100,000. In addition are what's left of a total 671,000 engines of all types delivered to Army, Navy and export during four years of war. Probably the market will quickly absorb all the grasshopper sizes, but mediums and heavies in surplus, discounting non-convertibles, would fill all requirements for years, unless distribution is controlled. Supercharged combat engines would not convert economically, and will be scrapped or stored. Probably all current equipment will be obsoleted by design improvements, and by gas turbine and possibly jet development, but not soon enough to save the industry from serious setback.

JAP DATA REQUESTS

WASHINGTON—Interested businessmen and industrial organizations who would like information on products or industrial establishments in Japan or Japanese-occupied territory, should forward questions relating to machine tools and similar production equipment to the Tools Division, War Production Board, Social Security Building, Washington, D. C. Questions should be submitted without delay.

Industry may be requested to furnish investigators for the Orient, and names of persons who might be available should be submitted to the Tools Division by those interested.



New Sky Giant—This is the 320-foot wing of the Hughes Hercules, called by its builders the biggest plane in the world. The plane is now nearing completion in the Hughes Aircraft Company plant in Culver City, Calif.

Canada Lay-Offs Continue; Aluminum Cuts Moderate

MONTREAL—Ever since the war ended plants across the Dominion have been laying off workers at an ever increasing rate. Latest of these is Noorduyn Aviation Ltd. which laid off 4,000 workers at the end of August. The closing was the result of a telegraphic notification from Ottawa stating that war contracts were cancelled immediately upon receipt of the wire. Cancellations stopped work on 25 Harvard advanced training planes per month. Noorduyn were also making components for Lincoln Bombers and they were turning out parts for Mosquitos under sub contract.

Aluminum Deliveries Reduced

While the end of the war against Japan has meant further aluminum cutbacks, these reductions were said to be comparatively light as most orders for war purposes had previously been cleared up. Most cancellations were for plane parts. All U. S. orders had been completed, including 170 million pounds since July 1 (a reduction of 175 million pounds from the original contract). Deliveries to Great Britain are still going ahead on a reduced scale, where much aluminum is being used in reconstruction work. Large quantities of aluminum are already finding their way into cooking utensils.

There was a decrease of 73.7% in time lost due to strikes in the first six months of 1945, compared with the same period in 1944, according to the Canadian Department of Labor. In 82 strikes during this period 25,208 workers were involved, with a time loss of 83,723 man days.

386 Surplus Plants Declared

WASHINGTON—Of major interest to manufacturers and production equipment suppliers is the Army's and Navy's declaration to surplus of 252 and 134 respectively, government-owned war plants for sale or lease.

Purchasers will find it necessary to re-tool and re-arrange most of the plants. Others, which produced civilian-type goods for war purposes, are practically ready to start rolling as is. Very few aircraft plants are listed and the assumption is that they are held in stand-by status for the time being.

Tentative Navy plans call for retention of 60 plants for emergency use. Navy would like to keep 27 uncompleted facilities in standby status. Navy has a partial interest in 142 plants built by DPC which also are to be sold. Officials said Navy would sell some of the 60 reserved in stand-by if purchasers would agree to produce in them what the Navy wants.

Names in the News

Harry W. Barkley

S. B. Taylor

Harry W. Barkley has been named executive vice president and general manager of the National Tool Co., Cleveland, Ohio. Previously a member of the Ford Motor Co., organization, he was superintendent of 5,000 men in the Highland Park plant.

S. B. Taylor has been elected president and a director of The Parker Appliance Co., Cleveland, Ohio. Mr. Taylor has been manufacturing vice president of The Reliance Electric & Engineering Co., Cleveland, since 1943.

Edgar W. Bartz has been appointed welding specialist for the San Francisco Bay area by the Westinghouse Electric Corp., Pittsburgh, Pa.

Robert W. Burgess has been appointed plant manager in charge of engineering and tool production of the Service Machine Co., Elizabeth, N. J.

N. J. Clarke has been elected senior vice president and **J. M. Schlendorf,** vice president in charge of sales of Republic Steel Corp., Cleveland, Ohio.

Frank C. Cline, has been appointed acting manager of the southwestern district for the Westinghouse Lamp Division with headquarters at St. Louis, Mo.

Leon P. Disinger, vice president of Buckeye Brass & Manufacturing Co., Cleveland, Ohio, has been named vice president and director of sales.

Morton I. Dorfan has been appointed manager of the dust and fume engineering division of American Foundry Equipment Co., Mishawaka, Ind.

C. S. Goddard has resigned after 27 years of service as general sales manager of Goddard & Goddard Co., Detroit, Mich. He is succeeded by **Stanley H. Grattan.**

Adolph G. Hochbaum has been appointed managing director for exports to U.S.S.R. and general sales representative for Central and Eastern European countries for the Baldwin Locomotive Works, Philadelphia, Pa.

Tye M. Lett, Jr., formerly of General Motors Overseas Operations, New York, has been named assistant director of exports for Crosley Corp., Cincinnati, Ohio.

R. A. Lewis is retiring as general manager of the Bethlehem plant of Bethlehem Steel Co., effective September 1. He will continue in a consulting and advisory capacity.

Maurice C. Libert for 17 years sales engineer in the Detroit office of New Departure, Division of General Motors, has been appointed manager of the San Francisco, Calif., office.

R. W. McLaughlin has joined Carrier Corp., Syracuse, N. Y., as assistant director of development in charge of the heavy machinery engineering section.

A. L. Meyer, chief of the steel plate section of the War Production Board's Steel Division at Washington, D. C., has resigned after more than three years' service with that agency to return to Great Lakes Steel Corp., Detroit, Mich. He has been appointed assistant eastern manager of sales for the Philadelphia and New York areas.

Charles H. Saiter

E. G. Cross

Charles H. Saiter has been appointed sales manager in charge of the heavy machine division of The Cleveland Crane & Engineering Co., Wickliffe, Ohio, a newly organized division.

E. G. Cross has been appointed supervisor of the production planning and control department of the Crocker-Wheeler Division, Joshua Hendy Iron Works at Ampere, N. J.

Charles A. Kirk has been elected executive vice president of International Business Machines Corp., Endicott, N. Y. He was formerly vice president in charge of manufacturing, in which connection he had entire charge of the company's Victory program.

Robert F. Moyer has been elected president and treasurer o fthe Asa S. Cook Co., New Haven, Conn. **Arvid N. Larson** has been appointed general manager to succeed **R. S. Crosby** who will continue with the company as consultant.

J. S. Murray has been appointed Pittsburgh district manager for the Alliance Machine Co., Alliance, Ohio. He was formerly chief electrical engineer for Follansbee Steel Corp., Pittsburgh, Pa.

Robert F. Nelson, formerly vice president of Arma Corp., has been elected vice president and assistant to the president, **R. G. Le Tourneau,** of R. G. Le Tourneau, Inc., Wall Street, N. Y.

W. E. Osband has been selected organization manager for the sales division of Packard Motor Car Co., Detroit, Mich., in an expanded postwar distribution program recently set up by the company.

J. Warren Roberts has been appointed branch manager of the Allis-Chalmers, Chattanooga, Tenn., office.

Ralph R. Root has been appointed sales manager of the electrical manufacturing division of the National Acme Co., Cleveland, Ohio. **M. L. Jeffry** is manager of the division.

It is reported that Major General Henry B. Saylor, former Chief Ordnance Officer of ETO, may become the new Chief of Army Ordnance, succeeding Lt. Gen. Levin A. Campbell, Jr.

Frank J. Schuman has been appointed district representative in Los Angeles, Cal., for the R-S Products Corp., Industrial Heat Treating Furnace Division, Philadelphia, Pa.

Richard F. Sentner has been appointed deputy director of the War Production Board's Steel division, succeeding **Harry M. Francis** of Cleveland, Ohio, who recently resigned to return to the American Steel & Wire Co.

Harold K. Turner has been named manager of the Dearborn branch of Ford Motor Co., succeeding **Harry A. Mack,** who has been transferred to Dallas, Texas as regional manager.

James E. Thoms has been appointed vice president in charge of sales and general administration for the Peerless Machine Co., Racine, Wis.

F. E. Williams has been promoted to general sales manager and **C. E. Sexauer** to service manager of the Zenith Carburetor division of Bendix Aviation Corp., Detroit, Mich.

Clarence Leslie Williams has joined the staff of sales engineers of The Foxboro Co., Foxboro, Mass., whose headquarters are in the company's New York office.

R. A. Williams has been elected executive vice president and a director of the American Car and Foundry Export Co., New York, N. Y. He is also vice president in charge of sales of the company.

James S. Wilson has been advanced by The Watson-Stillman Co., Roselle, N. J., to manager of plastics equipment sales.

BUSINESS ITEMS

New jobbers to handle the line of Aro Industrial Pneumatic Tools manufactured by **The Aro Equipment Corp.,** Bryan, Ohio, are: **Genessee Supply Co., Inc.,** Utica, N. Y.; **The Stellhorn Co.,** Toledo, Ohio, and **Cleveland Tool and Supply Co.,** Cleveland, Ohio; **J. Ernest Stroud Co.,** Amarillo, Texas; **Russ Chamberlin Co.,** Portland, Ore; **Industrial Engineering Equipment Co.,** Davenport, Iowa; **Electrical Appliance & Equipment Co.,** Wilmington, N. C.; **Electric Home Headquarters,** Minneapolis, Minn.

Carnegie-Illinois Steel Corp., Pittsburgh, Pa., has created new division of the general sales department, to be known as the specialty products division with headquarters in the Carnegie Building, Pittsburgh.

Certified Alloy Valve Co., has been formed as a new division of **The Cooper Alloy Foundry Co.,** Hillside, N. J.

Formal transfer of the controlling interest in **The Crosley Corp.,** Cincinnati, Ohio, to **The Aviation Corp.,** New York City, has been made by Powel Crosley, Jr., founder and head of the corporation since its organization.

The Doto Machine Works Ltd., Vancouver, B. C., has been incorporated in British Columbia for $20,000 capitalization. Registered offices are at the firm's address.

C. B. Hunt & Son Co., has been incorporated under the name of **C. B. Hunt and Son, Inc. N. C. Hunt,** retired, is succeeded by **N. A. Pedersen** who has represented the firm in the New York territory for a number of years. Mr. Hunt will become treasurer of the new corporation.

Paul A. MacInnes Tool Co. are newly located at 219 Smith St.—Corner Vincent St., Rochester 4, N. Y.

The Mid-West Abrasive Co. has established its central executive offices in Owosso, Mich., making that city the headquarters for one of the largest abrasive manufacturers in the nation. Construction of the offices at the Owosso plant began last fall, and the transfer of headquarters from Detroit has been accomplished.

Remington Rand, Inc., has removed the executive, sales, merchandise, and pricing departments of the systems division from Buffalo to 315 Fourth Ave., New York.

Standard Machine Works, Pasadena, Calif., has acquired designs and manufacturing rights for the complete line of plastic rubber and industrial hydraulic presses, formerly manufactured by the **Allsteel Pump Co.,** Los Angeles.

R. D. Wood Company's Philadelphia offices are located in the Public Ledger Building, Independence Square, as of September 1.

OBITUARIES

Harry W. Bails, purchasing agent for the past 39 years for Barber-Colman Co., Rockford, Ill., passed away July 22.

John B. Berryman, 83, chairman of the board of directors of the Crane Co., Chicago, Ill., since 1935, died in Chicago on August 10.

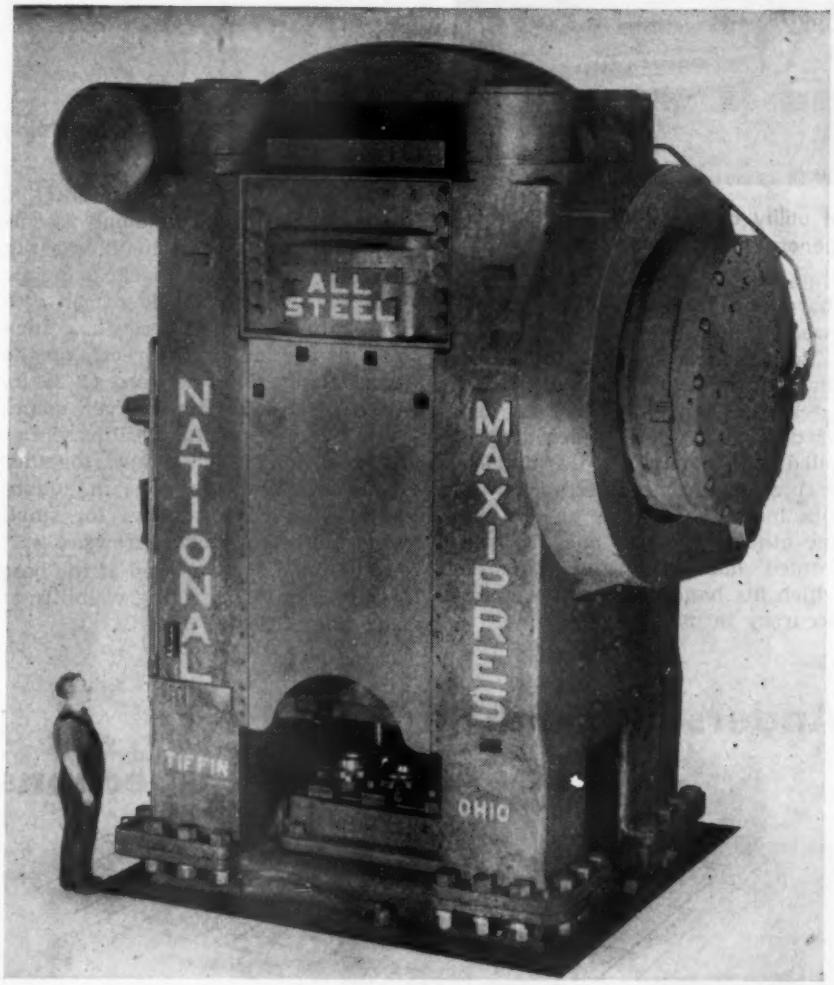
Henry Disston, 71, former president and chairman of the board of the tool manufacturing firm of Henry Disston & Sons, Inc., of Tacony, Pa., died August 29 in Bar Harbor, Maine. Grandson and namesake of the founder of the firm and son of Hamilton Disston, former president of the company, Mr. Disston was president from 1930-39, when he became chairman of the board.

Alexander Miller, 61, assistant manager, Canadian Machinery Co., at Vancouver, B. C., died recently at his home in that city where he had lived for the past fifty years.

F. Archer Thompson, 62, head of the Detroit office of the Bullard Co., machine tool plant at Bridgeport, Conn., died July 31 in Grace Hospital in Detroit of a heart ailment.

Shop Equipment News

High-Speed Maxipres Gives Continuous Flow of Metal



Maxipres holds "spring" to a minimum and provides a high degree of alignment and sharp die detail

A high-speed forging Maxipres, designated as No. 7½ and weighing 800,000 lb. is announced by National Machinery Company, Tiffin, Ohio. The press operates at 50 strokes a minute and is adaptable to such work as large wheel hubs, gear blanks, pipe flanges, crankshafts, connecting rods, side bar links and bearing races.

The flow of metal into the dies occurs uniformly throughout the height of the blank with pressure gradually increasing as the ram nears the bottom of its stroke. Dies may be made from high quality heat resisting steel in thin sections which are lighter in weight than those used in "impact forging."

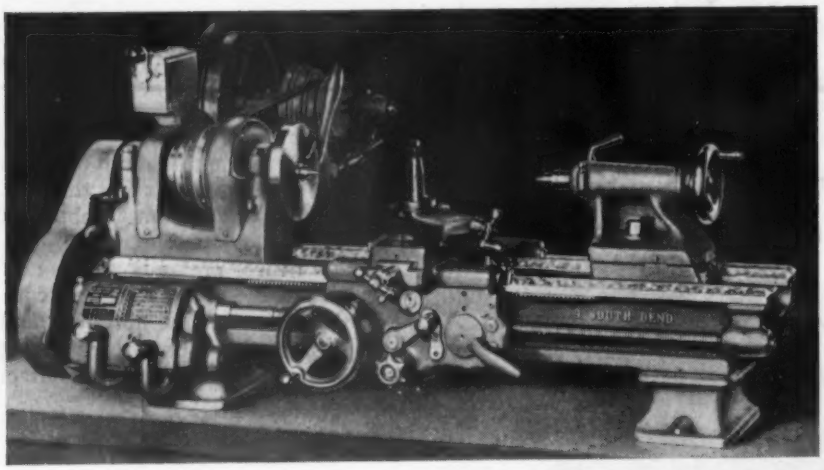
The press has a compact, preloaded bed frame; full eccentric alloy steel main shaft; special analysis high tensile bronze adjustable main bearings; long overarm piloted ram; adjustable side liners for the ram and an air-cooled pneumatic friction clutch. There is a minimum of joints between the main shaft and the dies. Vertical die adjustment is obtained by means of a double wedge (patented) which prevents floating of the bottom die and decreasing contact time between the hot stock and the dies. Positive and quick acting knockouts further reduces contact time.

Metco Spray Booth Features Metal Dust Collecting Unit

A line of spray booths and dust collecting equipment, designed expressly to handle metal spray dust, is announced by Metallizing Engineering Company, Long Island City 1, N. Y. Included in the line is a lathe exhaust unit which is mounted directly on the lathe carriage and moves with it. Also included are wet collectors and water wash spray booths which gather metal particles in a sludge sump where it may be reclaimed for salvage. Characteristics of the equipment include a sloping rear wall that eliminates eddies and recirculation, open type work table, down draft, dust trap and cleanout door.

Metco metal spraying booths provide ready facility for salvaging of metal dust which settles out in sludge tank

South Bend Precision Lathe Provides 16 Spindle Speeds



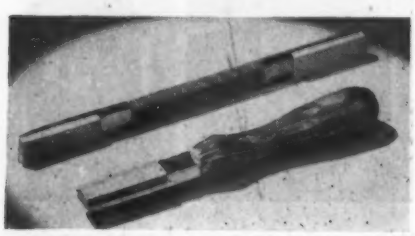
Standard South Bend attachments extend utility of this 9-in. bench lathe to toolroom, production or general maintenance

A V-belt Drive 9 in. precision bench lathe, utilizing 4-stempV-belt cone pulleys which, with the back gears, provide either 8 or 16 spindle speeds ranging from 46 to 1176 rpm, is announced by South Bend Lathe Works, 378 E. Madison Street, South Bend 22, Indiana. It is made either with quick-change gear or plain change gear equipment for a wide range of thread cutting longitudinal feeds. Two of the models incorporate power cross-feeds.

All models have 9¼ in. swing over the bed and saddle wings, and ¾ in. spindle hole with maximum collet capacity of ½ in. Choice of bed lengths give maximum distances between centers up to 34 in.

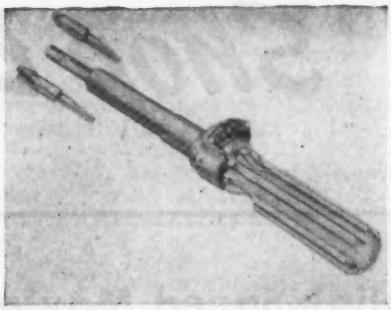
Bay State Diamond Hand Hones Are Produced in Pocket Sizes

Two pocket-size vitrified diamond hand hones are announced by the Bay State Abrasive Products Co., Westboro, Massachusetts. These diamond hand hones are useful for touching up carbide tools before they become too dull, keeping them sharp and prolonging tool life between grinds.



Bay state hand hones are designed for touching up edges of carbide tools

Both models are available with a diamond section 7/16 wide by 1 in. or 1½ in. long with 1/16 in. depth of diamonds. Both styles are supplied with plastic handles and each is furnished in a leather pocket case. One model has a hone at both ends, the other a hone at one end and a formed handle at the other end which fits hand and permits greater accuracy in use.



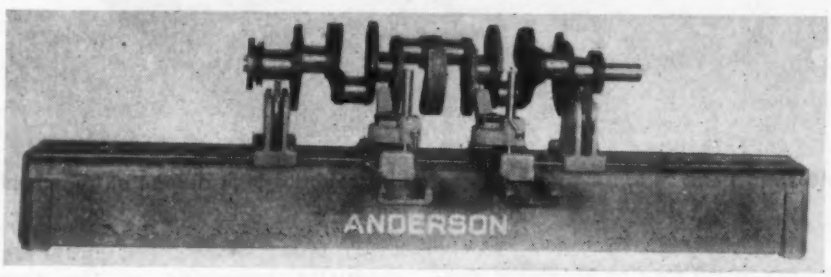
Apco torque screwdrivers follow basic lines and indicate tension by longitudinal displacement of parallel steel bars

Apco Torque Screwdriver Facilitates Hand Assembly

Apco Mossberg Company, 108 Lamb St., Attleboro, Mass., announces a torque screwdriver for hand assembly involving sheet metal, plastics or light metal. The basic principle and construction are identical with conventional torque wrenches. Inch pounds are indicated directly on the dial. Range is from zero to 25 in. lb. The torque screwdriver comes with two bits, one for Phillips screws and one for slotted screws, together with an adapter for a ¼ in. square socket to take wrenches for small nuts, studs and socket screws.

The indicator is placed at the base of the handle, providing visibility at any angle of use.

Anderson Crankshaft Checkers Simplify Alignment Inspections



The Roto-Checker can be used to check main-bearing misalignment and whip in the rod throws

For speeding up the operation of checking crankshaft bearings, the Anderson Bros. Mfg. Co., Rockford, Ill., have developed a special Roto-Checker.

The crankshaft is placed on four rotating discs and a number of indicators are brought into position and the crankshaft is revolved. One indicator can be furnished for each bearing.

The four discs roll on accurate ball bearings of Anderson design. The bases are made in two lengths—42 and 64 in. Larger Roto-Checkers can be made to suit special work.

Lodge & Shipley Lathes at work

. . . ACHIEVING A 250% INCREASE IN PRODUCTION OF TRANSMISSION MAINSHAFTS AT AUTOCAR

Faster and better output at lower cost—that's the aim of the automotive industry today. Production records of automotive manufacturers prove the unusual efficiency of the 3A Duomatic—Lodge and Shipley's full automatic lathe. Autocar, famed for heavy duty trucks has this to say about their Duomatics:

"Our transmission mainshafts are finished in four operations—two roughing and two finishing. The combined floor-to-floor time of these four operations is approximately 18 minutes. We previously used engine lathes on this part. Now, with our new Duomatics, we show a production increase of 250% over the old method."

In shops of every size and type, handling large or small lots, the Duomatic repeatedly demonstrates its amazing efficiency. Dual tool slides—front and rear—operate singly or together . . . are easily swiveled to cut from any angle. All movements and set-ups are entirely mechanical.

Have Lodge and Shipley Engineers show how the Duomatic can give you improved performance on your particular work. Write for Bulletin No. 601 showing standard cycles and other helpful data.

DO IT WITH A DUOMATIC

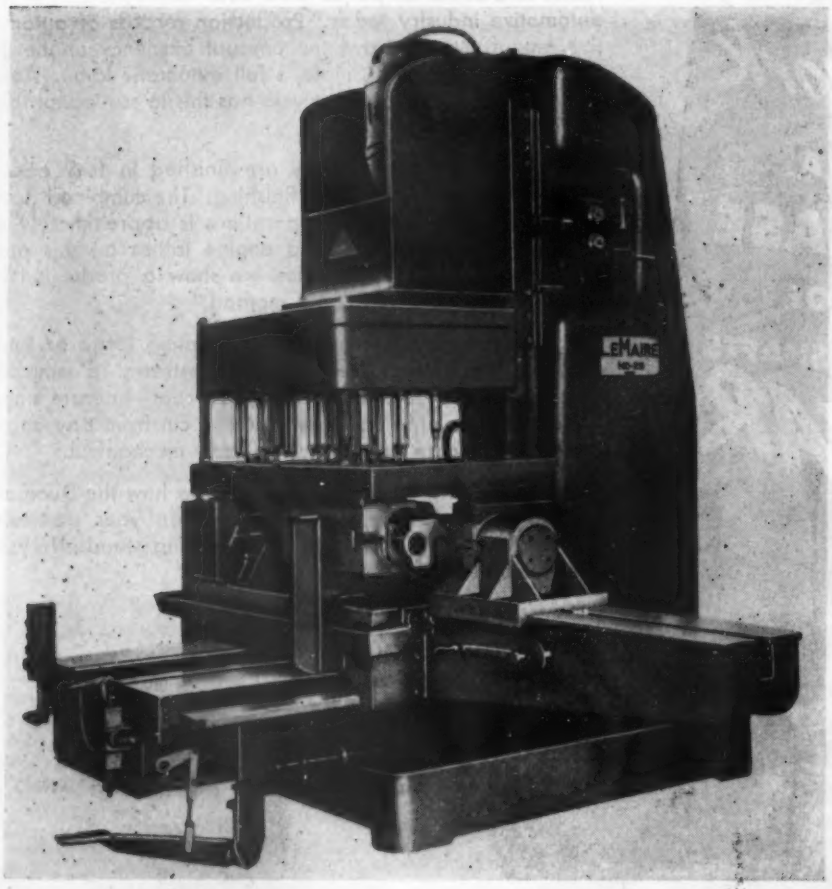
THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

L & S LATHES

ENGINE—TOOL ROOM—AUTOMATIC—OIL COUNTRY LATHES

LeMaire Special Drilling Machine Produces Precision Gun Parts



LeMaire Model 20 machine, equipped with a 25-spindle drillhead and shuttle-index table, drills all holes in a gun part on continuous cycle

A machine for drilling 24 holes in two working stations in a gun part has been announced by LeMaire Tool and Manufacturing Co., Dearborn, Mich. The standard Model No. 20 vertical drilling and boring machine has been equipped with a 25-spindle drillhead and a special 3-position, hydraulically actuated shuttle-index table, on which the part is loaded in a fixture.

After being loaded in the front position, the part is moved into the second position to have 20 holes of various diameters drilled. The part is then moved to the rear, or third position, where 4 more holes are drilled and 1 is reamed.

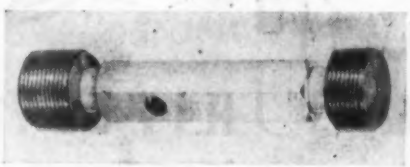
The second working station had to be provided because the center distances on some of the holes were extremely close and also because a reaming operation was required on one of the holes.

The bushing plate on the drill head is equipped with a special coolant valve and partition to allow coolant to be directed either to the front or to the rear working position when machine is in operation.

All controls are located at the forward loading station to permit single-point operation.

Master Gages of Tantung Alloy Raise Abrasion Resistance

The Master Gage Co., 2222 Fenkell Ave., Detroit 21, Mich., is manufacturing a line of thread plug gages made of Tantung, a non-ferrous hard alloy. The alloy contains cobalt, tungsten, chromium and tantalum-columbium carbide. The latter imparts a self-lubricating action which increases the resistance to abrasion of the combination. Tantung is dense and fine-grained which permits the generation of a surface with a minimum of microscopic irregularities. It is non-magnetic and resistant to corrosion by any of the commonly used acids or other active agents.



Master Tantung gages resist abrasion and abuse in handling

Air-rester Dust Collector Filters at Low Air Velocity

The Standard Electrical Tool Co., 2480 W. Sixth St., Cincinnati, Ohio, have added to their Air-rester line a belted motor-driven dust collector, designed primarily for 25 cycle current, but available for 60 cycle operation, if required.

Specifications on the two sizes are: AR-14B with ¾ hp. motor, 450 cu. ft. per min. discharge and dimensions of 24 × 19 × 52 in., the AR-24B, with 1½ hp. motor, has capacity of 1000 cu. ft. per min. discharge and dimensions of 24 × 23 × 59 in.

Air-rester dust collector is equipped with a top collecting chamber and removable filter pads

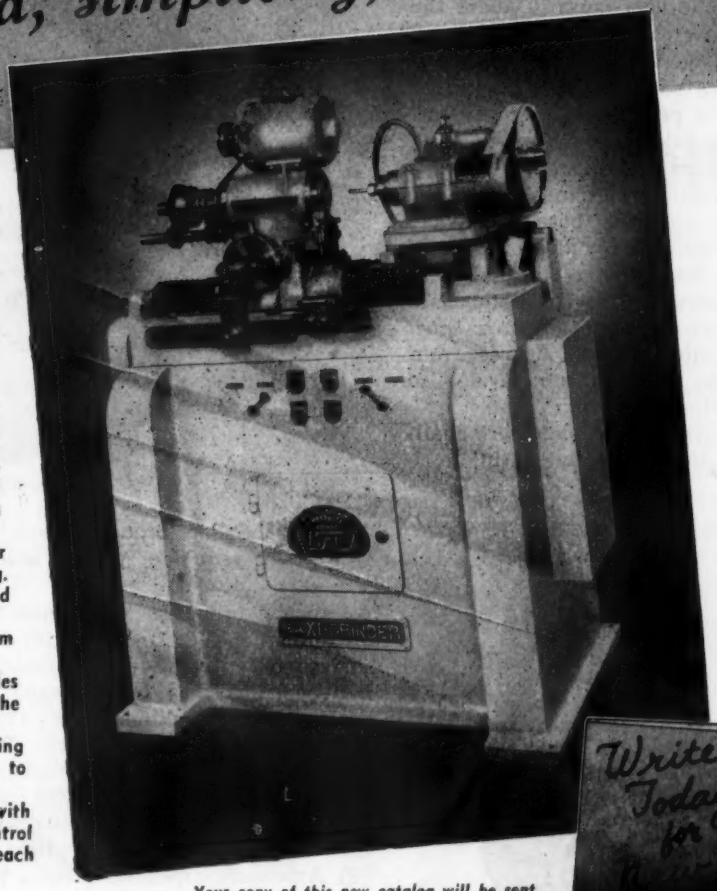
This unit is used for collecting dust from all types of grinding, buffing and polishing machines. The lower compartment contains the suction fan with motor, while the dust collecting chamber is located on the top of the stand. The dust collecting chamber is fitted with filtering pads for arresting the dust and allowing the exhausted air to leave the stand without perceptible dust, at low velocity and without

NEW! DIFFERENT!

A GREAT STEP FORWARD IN INTERNAL GRINDER DESIGN!

AMAZINGLY ACCURATE!

New Maxi-GRINDER features Unusual Design . . . Developments offer combined speed, simplicity, wide range



These features make the Maxi-Grinder outstanding as a fast, precision internal grinder:

Grouping of operating controls is such that operator's right hand is free to load and unload work.

Closing and opening of collet is entirely automatic . . . operated with a cam and lever arrangement.

A motor driven mechanical differential unit drives the ram in which the grinding spindle is mounted . . . positively eliminates bell-mouth holes. Length of stroke is easily adjusted, making it adaptable to grind shoulder and blind holes; has six speeds, can quickly be slowed with speed control switch for wheel dressing.

Diamond wheel dresser has a micrometer feed, quickly adjusted for automatic hole sizing.

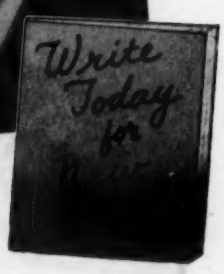
Hardened, ground and lapped ways are sealed against dust.

Feeding mechanism is absolutely free from backlash and is totally enclosed.

Setting up to grind taper and angular holes is simplified by use of a built-in sine bar on the work head (see above close-up).

Dust collecting system draws off all grinding dust, prevents clogging, glazing and adds to wheel life.

All functions are performed mechanically with electric motor power and push button control . . . a separate motor being used for each operation.



Your copy of this new catalog will be sent immediately on request. Write . . . get acquainted with this newer, better method of internal grinding.

Wilson Machine Products

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DETROIT 7, MICHIGAN

creating any objectionable draft or air movement.

There is a convenient clean-out door at the side.

Rotab Rotary Indexing Table Improved to Increase Accuracy

Improvements of several features of the Rotab indexing table are announced by the Machine Products Corp., Detroit 12, Mich.

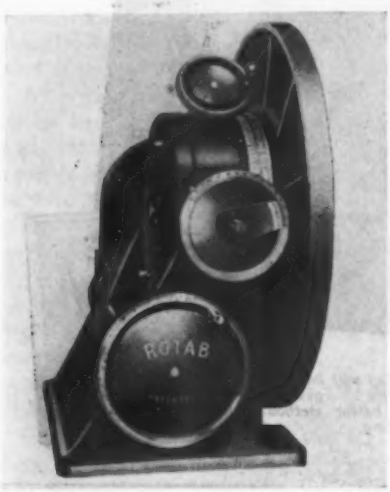
Among the improvements is a change in the design of the minute control dials. By having the verniers positioned on the same axes with the rotating members, synchronization is achieved and greater accuracies assured. New locations of vernier dials eliminate back-lash effects. This factor effective in those cases where the Rotab is used as a fixture for clamping parts on a boring mill or on radial drills.

The vernier for locating the table is conveniently located beneath the table. The vernier controlling the angular tilt of the table is placed opposite the gear control where the sine bar can be attached for second readings, if required.

The slotted faceplate is surface finished to provide an accurate reference surface for work set-ups and the verniers are directly indicative of the angular relation between the faceplate and the base reference, which is finished for alignment with machine bases.

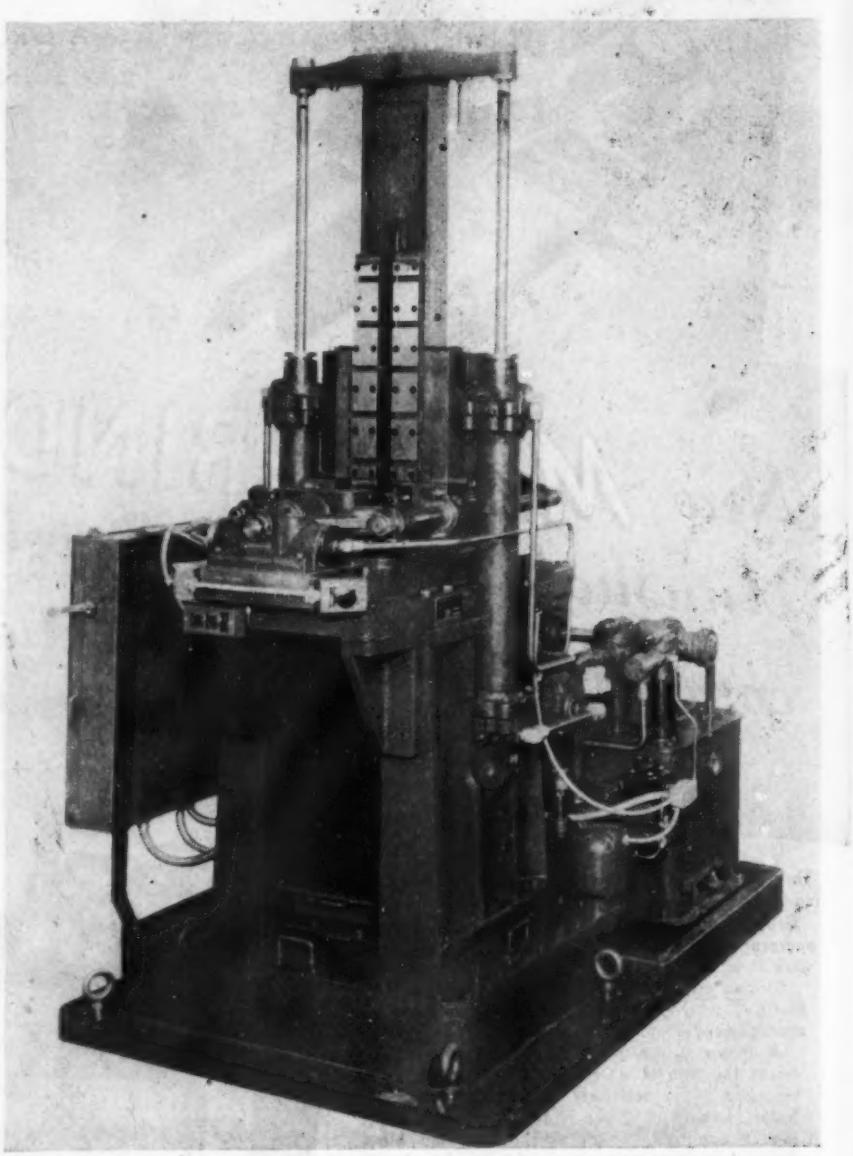
The faceplate can be rotated to any degree and, at the same time, can be tilted to any degree from vertical to horizontal and 30 deg. in an opposing direction.

Three sizes of faceplates are available; 12 in., 24 in. and 36 in.



Rotab indexing table sets work at compound angles by dial settings

Hy-Mac Bearing Broach Operates On Completely Automatic Cycle



Hy-Mac bearing broaching machine operates on a fully automatic cycle requiring manual loading and unloading operations

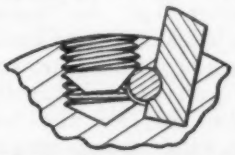
A special purpose machine for broaching the I. D. and split-line surface of automatic-type precision half-bearings, has been completed by Hydraulic Machinery, Inc., 12825 Ford Road, Dearborn, Mich. The cycle of these vertical type machines is entirely automatic except for loading and unloading. Cycle of operation: (1) Manual-Load Bearing (2) Automatic-Operator presses two palm buttons (safety feature prevents operator from getting his hands in the working mechanism) (a) Nest block moves in and clamps bearing (b) Nest block is locked in position (c) Broaching slide moves down (stroke adjustable through dogs contacting limit switches) (d) Nest block is unlocked and returns to loading position (e) Broaching slide moves up, end of automatic cycle (3) Bearing is manually unloaded.

Advantages of this special purpose machine are high production, positive alignment and clamping of bearings, adaptability to different sizes of nests for various sizes of bearings and adjustable broaching speed. The machines are powered by a Hy-Mac hydraulic power unit. The cycle of the machine is accomplished by hydraulic sequence valves, solenoid operated 4-way valves, pressure switches, limit switches and

for Fast Dependable Operation

For increased production—of a better product—at lower cost—specify McCrosky Super Adjustable Reamers. They combine the rigidity needed for heavy duty turret lathe work, utmost accuracy, and McCrosky's service-proved pin and screw locking device.

Originated and perfected by McCrosky, and available only in McCrosky Reamers, this pin and screw lock holds the blades securely in the slot even when in fully extended position,—without restricting the clearance for chips and lubricant. It permits blades to be released easily, and adjusted uniformly and accurately. Consequently, McCrosky Reamers can be reground with minimum loss of blade stock—a particular advantage when carbide tips are used—and a minimum number of tools are needed, to keep a job in continuous operation.



Sectional View Showing Bearing Screw and Pin That Hold the Blade Rigidly Against the Reamer Body.

McCrosky Super Adjustable Reamers are furnished with straight or tapered shanks—or in shell design for mounting on arbors or line bars. High speed, cast alloy or carbide tipped blades. Standard sizes to 6" in diameter,—other sizes, and multiple operation tools that combine related facing, boring and reaming operations—do them all simultaneously in just one operation—furnished on special order. Write for fully descriptive bulletins.

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

COST CUTTING TOOLS

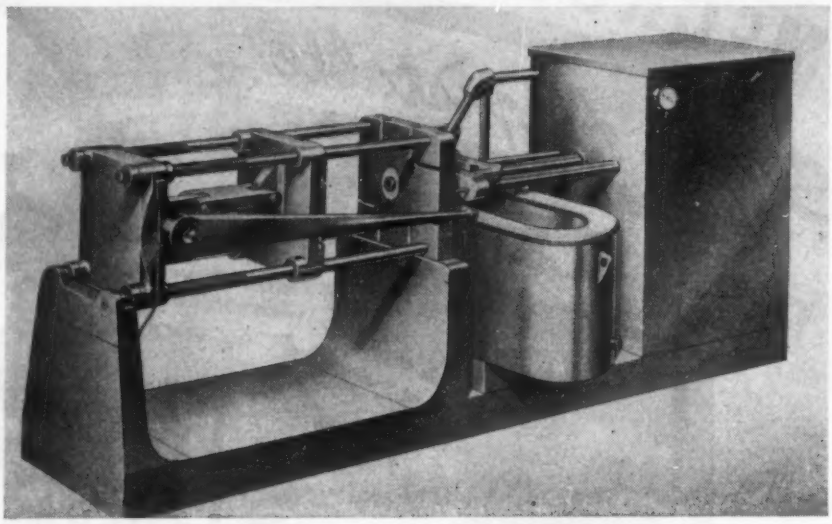
Designers and Manufacturers of
Jack-Lock MILLING CUTTERS
Block Type BORING BARS
Wizard CHUCKS AND COLLETS
Super Adjustable REAMERS
Turret TOOL POSTS

a special electrical control panel. The movement and locking of the nest block is accomplished by cylinders built into the nest block slide. The movement of the broach slide is accomplished by two swivel type cylinders with adjustable cushions at both ends.

Built into the base of the machine is a coolant pump and sump. Directly under the broaching station are two metal baskets, the first for catching chips and the second for screening the coolant. The broaching stroke is adjusted at the rear of the broaching slide. The nest block clamping is adjusted at the front of the nest block slide. The nest is adjusted at the sides of the nest block. Nest can be removed from the nest block by removing four holding screws.

The centralized location of all controls, at the front of the machine, reduces machine idle time and also reduces the motions required for operation of the machine.

Harvill Die Casting Machine Has Horizontal Ram Action



Harvill die casting machine dies are opened and closed manually with metal feeding being continuous

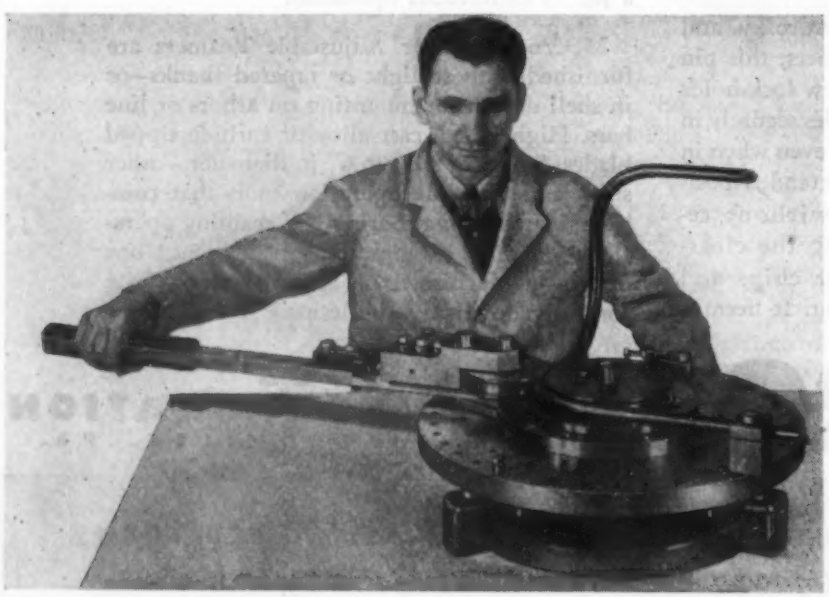
H. L. Harvill Manufacturing Co., Vernon, Cal., announces Model HD-1AM1 die casting machine for casting tin, lead and zinc alloys in the medium size range. The machine will accommodate dies having a vertical dimension of 8 in. and a horizontal dimension of 12 in. Travel of the moveable platen permits a dimension of 6¼ in. between the die faces, the dies having a maximum thickness of 14 in. Operation of the moveable platen is by a hand lever. When oversize dies are used the die itself overhangs the platen and, if excessive in weight, must have an auxiliary support.

Injection of the metal is accomplished by a horizontal ram similar to that used in cold chamber equipment rather than the "gooseneck" injection assembly. Continuous feed from a gas or oil-fired furnace is an integral part of the machine and constantly supplies the injection chamber with molten metal. Each shot injects up to 3 lb. of zinc under normal circumstances, the maximum being 6.1 lb. of zinc.

When less than 3 lb. of zinc or an equivalent volume in tin or lead is injected a pressure of 1200 psi is exerted on the metal in the die cavity. The minimum metal pressure, using a large piston to accommodate the maximum metal injected, is 600 psi. Impetus to the injection ram is supplied by compressed air and the reservoir requires 1 cu. ft. of air per minute at 150 psi to sustain 400 cycles per hour.

Redesign Di-Acro Bender To Increase Forming Capacity

Introduction of three Di-Acro Bender models, incorporating several major changes over original models, is announced by O'Neil-Irwin Manufacturing Co., Minneapolis 15, Minn. Approximately 35 percent additional forming capacity is said to have been gained by installation of roller bearings which substantially reduced operating friction. The forming direction of the larger No. 2 and 3 benders can be instantly reversed by a control lever to eliminate interference when forming metals to complicated shapes and forms. These benders can be arranged on the job for all types of forming in all ductile materials, including round, half round, square or hexagon rod, tubing, angle, channel and bus bar.



Di-Acro Benders form tubing without inside supporting mandrels

1ST QUARTER 1944

2ND QUARTER 1944

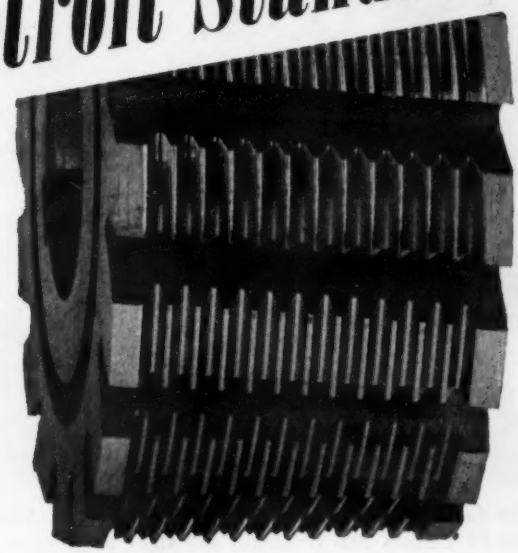
3RD QUARTER 1944

4TH QUARTER 1944

1ST QUARTER 1945

ORDERS FOR DETROIT STANDARD THREAD MILLING CUTTERS

They're Specifying Detroit Standards



Look at that quarter by quarter record of orders for DETROIT STANDARD thread milling cutters—yes, and DETROIT makes specials, too.

Those DETROIT standards—amplified by new types and sizes as needed—are becoming the accepted standards of Industry.

Many companies now simply order their thread milling cutters by DETROIT STANDARD Blank number and desired thread form. Eliminates Tool Engineering, saves delivery time.

Detroit Thread Milling Cutters, standard and special, are making unnecessary the slower more costly method of grinding on scores of precision threaded parts.

Ask for latest Bulletin giving standard sizes

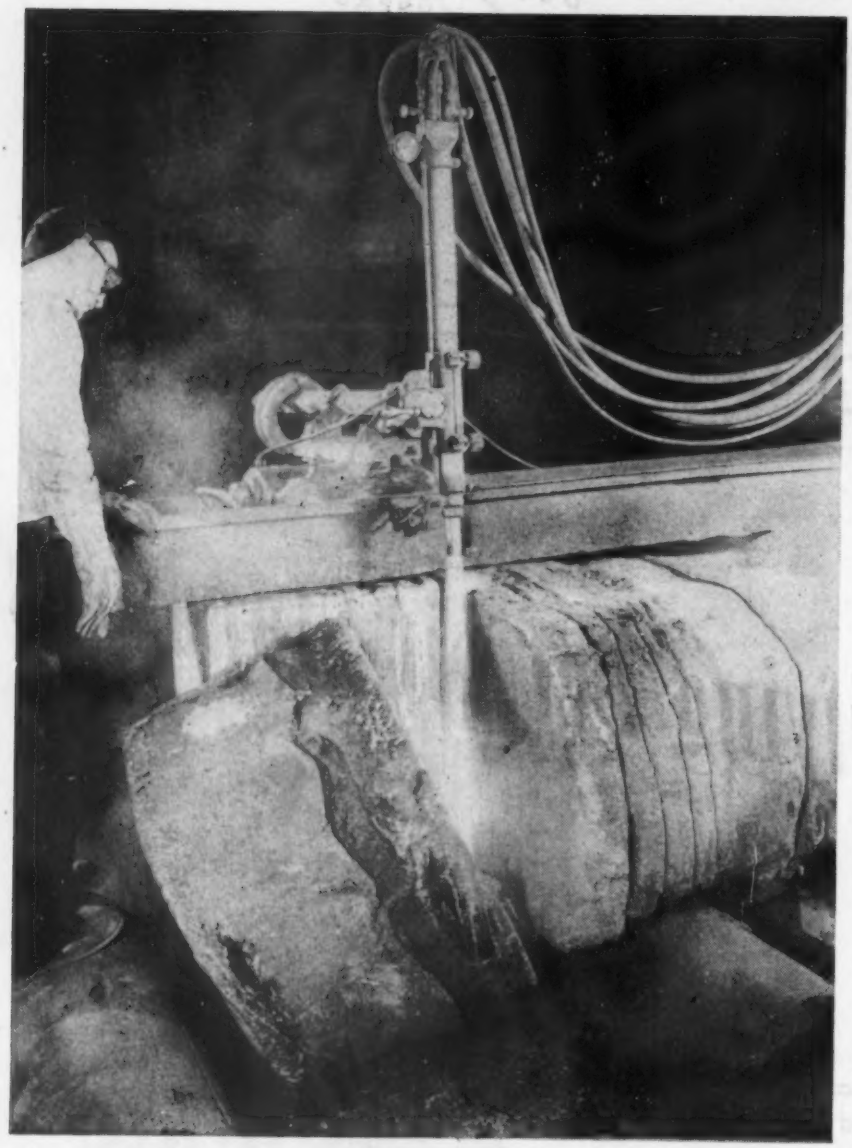
TAPPING MACHINES
TAP RECONDITIONERS

DETROIT TAP & TOOL CO.

TAPS—THREAD GAGES
CUTTER HOOK AND SPACING CHECKER

8432 BUTLER AVE. DETROIT 11, U.S.A.

Oxweld Heavy-Duty Blowpipes Cut With Speed of Oxygen Lance



The Oxweld C-45 machine-cutting blowpipe, shown mounted on an Oxweld CM-21 cutting machine, will cut steel ranging in thickness up to 50 inches

A heavy-duty, oxyacetylene, cutting blowpipe has been developed by The Linde Air Products Co., 30 E. 42 St., New York, N. Y. This blowpipe, which cuts steel ranging in thickness from 16 in. to 50 in., is suited for hot top cutting, ingot slitting, riser cutting, cutting large forgings, and scrap cutting in many applications where the oxygen lance was formerly required.

The C-45 is water cooled and is intended to be mounted on a heavy-duty, straight-line cutting machine. A 50-lb. gage is attached to the blowpipe body for checking cutting-oxygen pressures which are unusually low—never over 35 lb. per sq. in. The C-45 blowpipe is designed for operating with medium-pressure acetylene and will operate satisfactorily on a generator or a manifold having a minimum hourly capacity of 500 cu. ft. of acetylene. Unless cutting oxygen is supplied from a pipe line, at least 10 cylinders should be manifolded to provide sufficient capacity. In shops where steel over 18 in. thick must be cut frequently, the C-45 blowpipe provides a tool for making these cuts quickly and economically.

Also available is the Oxweld C-45 blowpipe holder, which has been designed especially for this blowpipe. It provides ease, accuracy, and stability in making vertical and angular adjustments. Vertical adjustment is obtained by turning a ball crank which operates a worm and gear that meshes with the blowpipe rack. A total angular adjustment of 135 deg. can be obtained in the plane of the cut.

Federal Dial-Type Snap Gage Indicates Variations in Parts

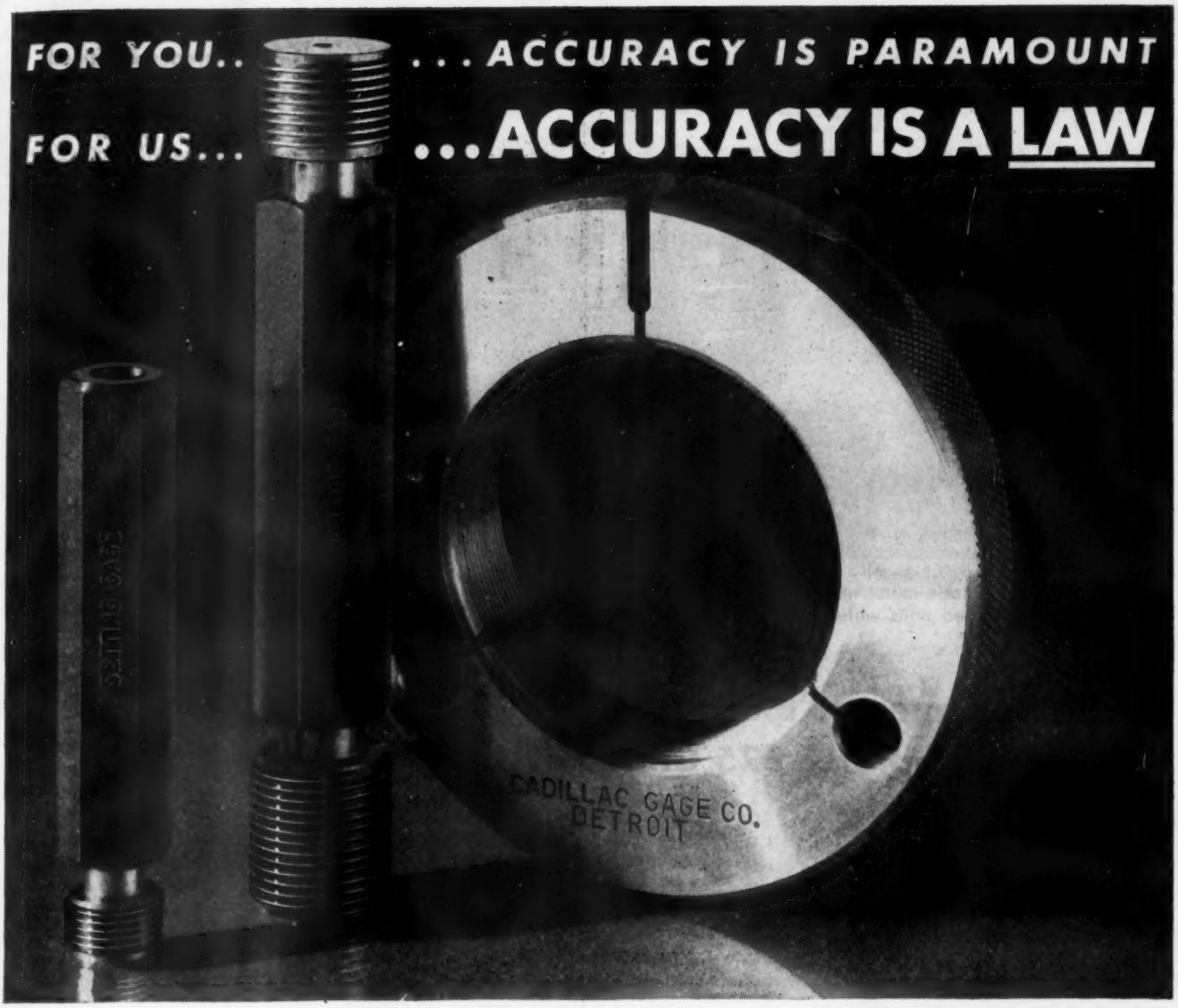
Federal Products Corporation, 1144 Eddy St., Providence, R. I., are the manufacturers of a snap gage with a dial to indicate dimensional variations from specified tolerances. It visualizes the actual dimension of the workpiece. It has all the simplicity, compactness and utility of the snap gage with the addition of defining, positively, that there is a variation in the specified dimension and, in addition, it tells how much the dimension varies from the specified tolerances.

It is a single-purpose type of gage, the dial of which is graduated in .0001 in.; has a range of .008 in. and can be made to suit any dimension between ⅛ and 1½ in. It weighs approximately seven ounces complete with the indicator.

The weight of the gage rests on the rigid upper anvil, therefore, it cannot influence the indicator reading. The lower anvil is a flexible, solid piece of metal which transfers the variation in the dimension from the workpiece to the dial indicator. Both anvils are tungsten carbide tipped for long wear. It has an insulated finger grip to protect the readings from variations of temperature induced by body heat.

The construction of the gage assembly permits its manufacture with exceptionally thin gaging members suited for use in restricted spaces between raised shoulders.

Federal dial-type snap gage eliminates the sense of feel as a factor in inspecting parts to close tolerances



CADILLAC Gage accuracy pays you dividends . . . in faster, easier assembly, in less "rejects" and "scrap." You get more O.K.'d pieces per run . . . more quality production at less cost—more *PROFIT!*

Cadillac maintains the highest standards of gage making art throughout the entire manufacturing process of jewel-like ring and plug gages. From the first inspection of the raw stock until the gages have passed the highest standards of final inspection . . . accuracy is in truth a law.

10,000 Cadillac Gages in standard sizes are in stock . . . for fast delivery. Just PHONE us your requirements and we'll ship at once.

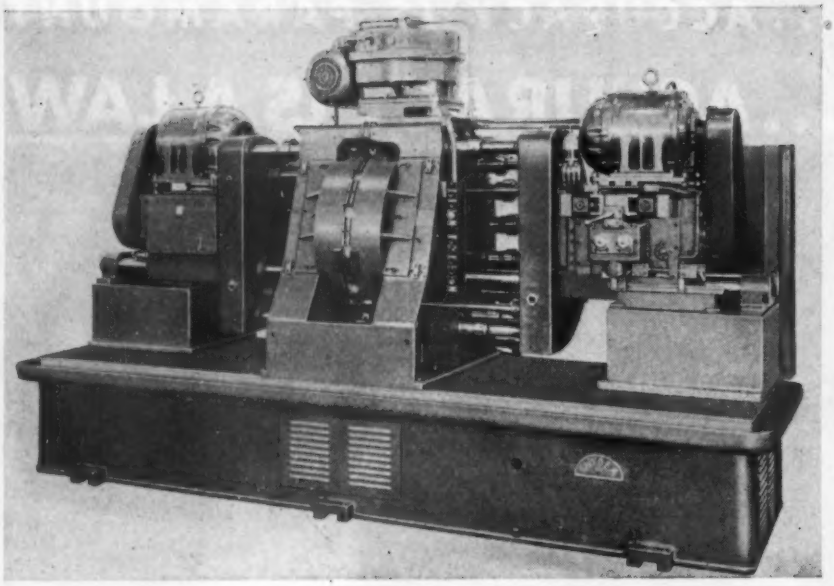
Try Cadillac Gages and watch your standards of accuracy mount.

PHONE US—*REVERSE THE CHARGES!*

Your inquiries are welcome. Phone us regarding any gage problem. Reverse the charges.

Cadillac GAGE COMPANY

20316 HOOVER ROAD • DETROIT 5, MICHIGAN



Snyder convertor blade miller indexes through the full cycle and discharges finished units without attention of the operator

Snyder Convertor Blade Miller Completes 575 Units Per Hour

Snyder Tool and Engineering Co., 3400 E. Lafayette, Detroit 7, Mich., has designed and built a special-purpose, double-end machine for hollow milling one or two trunnions on convertor blades of various shapes and sizes.

In this machine, two Snyder self-contained hydraulic units and multiple heads and an electrically driven fixture trunnion with holding jaws, are assembled on a welded steel base. The coolant tank is in the rear of the base. Tool spindles are guided in the trunion side members and are equipped with precision end stop adjustment to maintain accuracy and depth of cut. The trunnion is indexed station to station by a Geneva index mechanism mounted on top of the trunnion assembly.

Parts are located in the jaws by means of two side locating plates. Each fixture has an individual hydraulic cylinder which automatically clamps the part while the fixture indexes from loading station to first working station. Each index station has three fixtures holding three parts, each of which is identically machined at the same time as the cycle controls are inter-linked for the three part stations.

The work-cycle consists of an index followed by the tool work and is semi-automatic, requiring the operator to press a button after loading three pieces. Unloading is automatic.

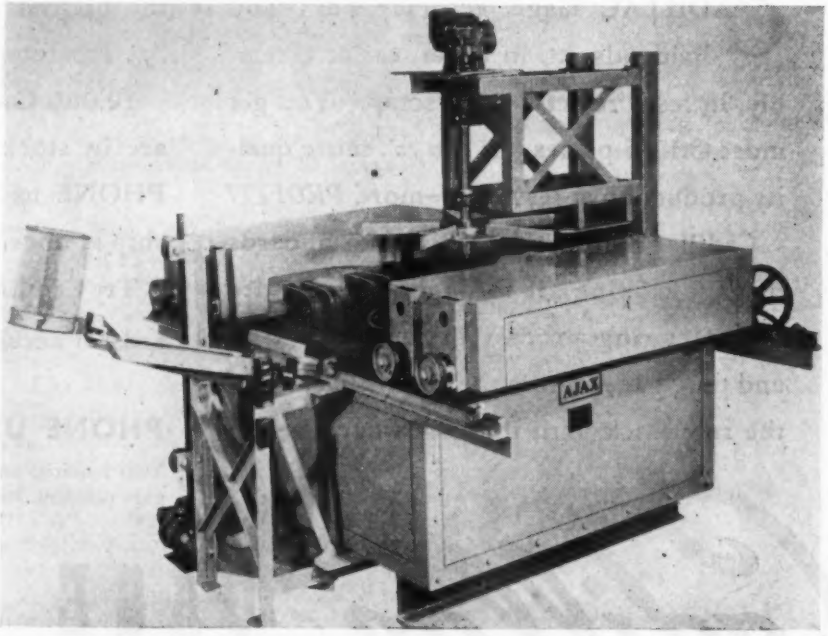
Work parts of various shapes and sizes are accommodated by exchanging the holding jaws on the fixture and adjusting the side locating plates. Production is 575 units per hour at 80 percent efficiency.

Ajax Salt Bath Furnace Equipped With Rotary Loader for Part Trays

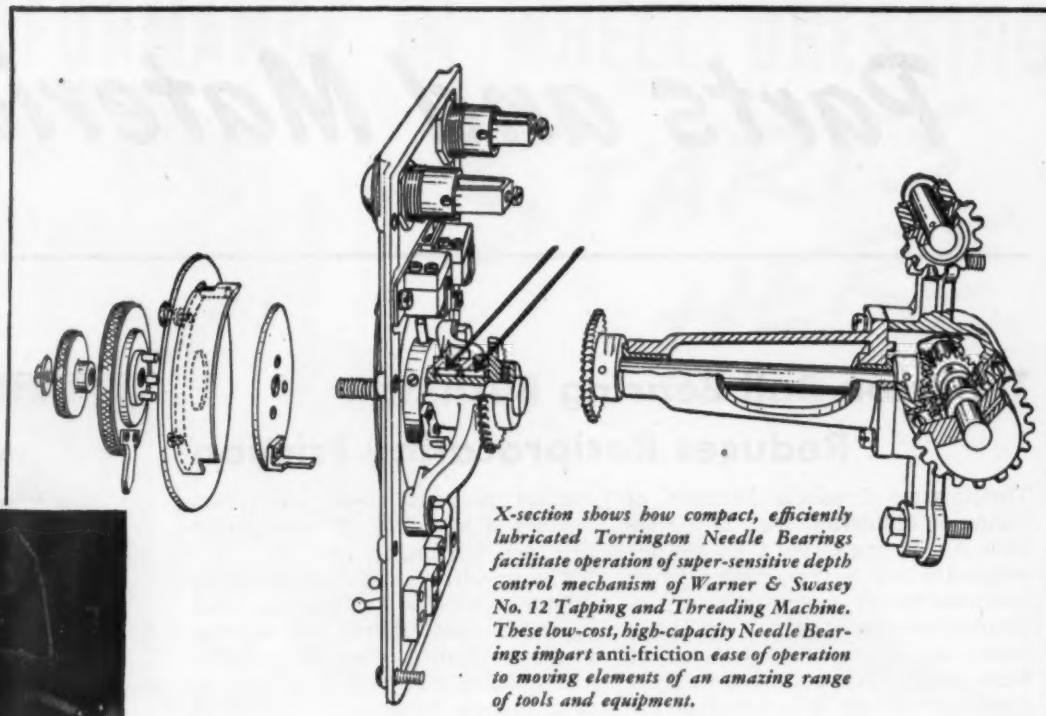
An Ajax-Hultgren salt bath furnace manufactured by the Ajax Electric Co., Frankford and Delaware, Philadelphia 23, Pa., automatically removes baskets laden with small work upon completion of the hardening heat treatment in the molten salt. A motor driven mechanism rotates five heat-resisting alloy wire baskets through the liquid bath. Each basket remains in the furnace for an identical period of time, which may be simply adjusted by means of a controlling time switch for any time cycle desired.

Parts to be heat-treated may be either manually or automatically loaded into the baskets. A motor driven transfer arm engages one basket at a time and quickly swings it out of the furnace, emptying the parts into an adjacent quench tank. Baskets may be emptied, returned, reloaded and again charged into the hardening furnace in approximately half a minute.

The automatic cycle, which holds immersion time to preset intervals, allows heat-treating specifications to be held to closer tolerances and minimizes temperature variations in the salt bath. Quick return of the containers to the bath, after emptying, insures a minimum loss of salt and heat loss of the baskets is reduced. All mechanical parts are protected.



The Ajax furnace loader picks up loaded baskets, submerges the load in the salt bath and automatically removes treated loads to a quench tank



X-section shows how compact, efficiently lubricated Torrington Needle Bearings facilitate operation of super-sensitive depth control mechanism of Warner & Swasey No. 12 Tapping and Threading Machine. These low-cost, high-capacity Needle Bearings impart anti-friction *ease of operation to moving elements of an amazing range of tools and equipment.*

Sensitive Depth Control Mechanism Operates on Torrington Needle Bearings

A prominent feature of the Warner & Swasey tapping and threading machine that you see above is the depth control mechanism, which controls depth of thread within 1/10 revolution of the tap. And a prominent feature of this super-sensitive mechanism is that it operates on compact, smooth-rolling Torrington Needle Bearings.

"We specify Torrington Needle Bearings here," Warner & Swasey designers report, "because they permit compact design where accuracy and sensitivity are vital in this precision assembly, and help it operate smoothly with minimum friction."

Helping tools and equipment *operate smoothly with minimum friction* is the year-around job of these small, high-capacity, maintenance-free Torrington Needle Bearings. Perhaps they can do such a job for *your* tools and equipment. Our new Catalog 32 gives full data on types, sizes and applications. May we send you a copy?

•

THE TORRINGTON COMPANY

Established 1866

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New York Boston Philadelphia Detroit Cleveland Seattle Chicago San Francisco Los Angeles Toronto London, England

TORRINGTON NEEDLE BEARINGS

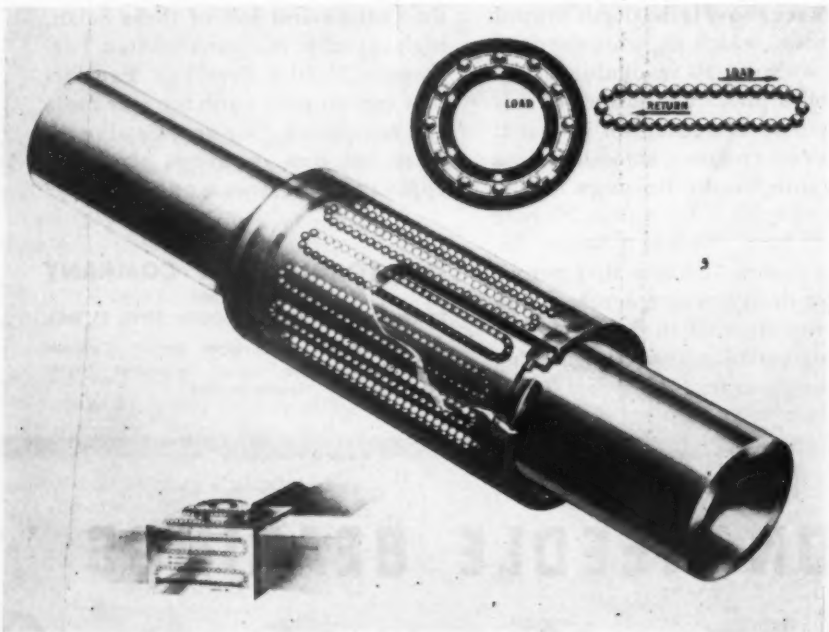
Parts and Materials

Thomson Ball Bearing Bushing Reduces Reciprocating Friction

Thriftmaster Products Division of Thomson Industries, Inc., 29-05 Review Ave., Long Island City, has developed a ball bushing that permits unlimited travel of reciprocating mechanical members that may be either round or square, or variations of these shapes. The advantages gained from the use of ball bearings for rotating parts can thus now be obtained on sliding members.

Basically, the ball bushing contains within it a series of ball circuits. One side of the circuit carries the bearing load with the other side returning the balls in a clearance provided in the outer race member of the bushing. Free movement is obtained because of the maximum elimination of friction. The continuous bearing prevents cocking or binding on the shaft because the bearing balls remain constantly centered under load. Rolling contact plus sealed-in lubrication enables a long life of anti-friction precision alignment.

The system of ball circuits can be infinitely varied for varying load capacities and shapes of bearing members. Thus it is possible to have a bearing of considerable length or of a square, hexagon or octagonal section.

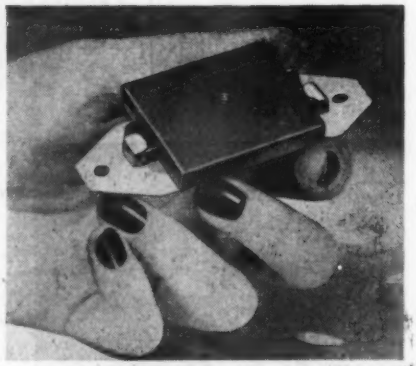


The Thomson ball bushing provides a rolling ball contact for linear motions. Provision for a loaded linear race with an unrestricted return permits fixed and reciprocating members to pass with a minimum of friction

Rexon Light-Duty Vibration Mounts Raise Safety Factor

A light-duty vibration mount announced by Hamilton Kent Manufacturing Co., Kent, Ohio, will handle loads as low as one pound or as high as 200 lb. with the same type of mount construction.

Light-duty Rexon mounts are designed to eliminate disturbing vibration and noise from small motors, typewriters, business machines, household appliances or small power tools or to isolate delicate instruments from external vibration.



Rexon light-duty mount combines the properties of rubber shear-loaded types and compression mounts

These light-duty mounts incorporate the same principle of vibration isolation in the heavy-duty series announced last fall. This principle of mount design combines the high vibration dampening properties of rubber loaded-in-shear, with the safety, durability and ease of installation of a compression mount. With Rexon mounts no overloading of the shear elements is possible, which makes specification of the proper mount simple.

Five sizes of light-duty Rexon mounts will handle a range of loads from 1 to 200 lb.

Stoody Hard-Facing Alloys Are Applied Electrically

For metals which cannot be satisfactorily hard-faced with oxy-acetylene equipment, such as heavy equipment or intricate shapes where heat treatment or desirable physical properties of the base metal may be destroyed by the torch flame, the Stoody Co., Whittier, Calif., offers two hard-facing alloys for electrical application known as Stoody 1 and Stoody 6. A special dipped coating permits application with either a.c. or d.c. equipment and protects the alloying elements so that weld de-

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posits are produced having the same analysis and physical properties as those applied by oxy-acetylene torch.

Rapid burn-off rate with low penetration and high buildup are normal operating characteristics of both coated electrodes. Porosity and shrinkage cracks are almost completely absent in coated Stoody 6 deposits, and their presence is further minimized by slow, even cooling. Because elongation of coated Stoody 1 is nil, some shrinkage cracks may occur in deposits applied electrically.

Dow Silicone Rubber Released For Commercial Production

Dow Corning Corp., Midland, Mich., announces the commercial availability of Silastic, a silicone rubber, produced in various stocks for molding, extruding, coating, and laminating. Largely because of their inorganic origins, these rubbery organo-silicon oxide polymers remain elastic after heating at temperatures up to 500 F. and retain flexibility at temperatures as low as —70 F.

Silastic stocks are available for molding flat sheets, gaskets and other shapes. Silastic coated lead wire and other continuous extruded shapes are made from Silastic stocks designed for extruding.

Also available are Silastic stocks compounded for coating glass or asbestos cloth to produce flexible, waterproof, heat stable, oil resistant gaskets, diaphragms, tape and electrical insulation which is nontracking, arc and oxidation resistant. Laminates may be made by curing under pressure, multple layers of Silastic coated in organic fabrics. Silastic is also used to insulate wire wound resistors with waterproof, heat resistant, elastic coatings able to withstand the severe and repeated thermal shocks specified for Grade 1 Class 1 resistors.

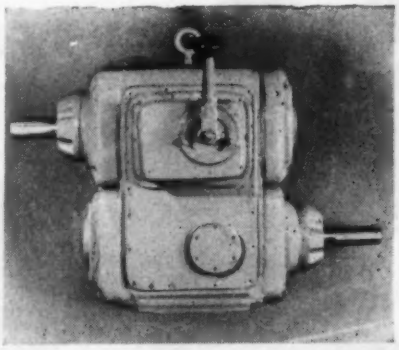
Silastic coatings adhere to glass, vitreous enamel, iron, steel and aluminum. They are resistant to oil and salt brines at elevated temperatures.

Silastic stocks now available have tensile strength of from 200 to 330 lb. per sq. in. elongation ranging form 70 to 115 percent, high resistance to water, brine and oil, and electrical properties of the following magnitude: dielectric constant at 1,000,000 cycles of 5.0 to 7.5; power factor at 1,000,000 cycles of 0.13 to 0.18 percent; and dielectric strength of 500 volts per mil.

Portman Hydraulic Drive Unit Maintains Constant Torque

The Model HT-1 hydraulic variable speed transmission is manufactured by the Portman Machine Tool Company, 70 Portman Rd., New Rochelle, N. Y.

This model is intended for use as a variable speed drive unit for industrial applications calling for continuous duty performance under varying conditions of load and speed that must be closely controlled.



Portman variable speed hydraulic transmission has been designed to deliver maximum horsepower at constant available torque output rating

Infinitely variable speeds are available from zero or full neutral position to maximum motor speeds both forward and reverse. In this drive unit torque output remains constant at all speeds.

Various types of control mechanisms in addition to the hand lever shown are available to suit all applications, including remote control stations and automatic progressive control devices.

Over-all dimensions are: 8½ in. wide, 16¾ in. high, 18½ in. over-all housing length, diameter of shaft—1⅜ in., shaft extension length—3½ and 4½ in.

Horsepowers available are 5, 7½, 10, 15 and 20. Maximum speed depends upon the speed of electric drive motors or other prime movers, such speeds are rated at from 900 to 1700 r.p.m., with this type unit for constant torque operation.

In addition to the individual unit type hydraulic variable speed transmission, this same transmission can also be furnished, complete, with electric drive motors for various electric current specifications and to include base for the mounting of the hydraulic transmission and the electric motor, starters and other controls suited to the particular application.

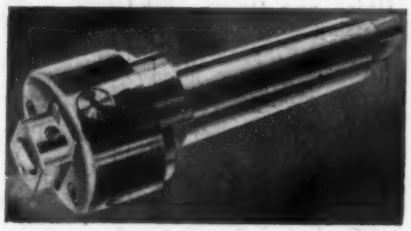
Telescopic Conveyor System Can Be Extended in Length

An accordion-type conveyor system, built by Food Machinery Corp., Riverside, Calif., can be extended to three times its original closed length to suit variable requirements. Manufactured in closed lengths of 21 to 35 in., it can be extended to lengths from 60 to 100 in. When not needed, it can be closed to the minimum size and stored.

The supporting legs are provided with steel pads to permit use on soft surfaces.

DeSoto Boring Chuck Sets To Zero for Center-Drilling

A boring chuck is announced by the DeSoto Tool Co., 16 Sproat Street, Detroit 1, Mich. Using this chuck, when drilling is required, the operator removes the boring bar, brings the chuck to dead-center by moving the adjusting screw back to the end of travel and setting to zero; the boring chuck is then ready to receive the drill chuck. It is held in place by two hold-down screws. After center drilling and open drilling to the required size, the drill chuck is removed and the boring bar inserted again for the boring operation. In this same manner, the DeSoto chuck may be used as an adaptor for most special tools such as end mills, cutters, key-way cutters, saws or fly-tools.



The DeSoto boring chuck can be used as an adaptor for special tools

With the precision adjusting screw the boring bar can be moved to within 0.001 in. of the hole size required. This being a positive adjustment, duplicate holes can be bored by setting the graduation the same on each hole in the series. Construction consists of four hardened, ground and lapped parts. The shank is alloy steel hardened and drawn to a Rockwell 45-50, ground all over with a taper 0.0003 in. oversize at the large end to increase the pressure at this point when inserted in the machine.

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The right cutting oil for the right operation can make the difference between rejects or parts which meet the most exacting requirements. This was amply proved by a manufacturer of precision parts when he switched from a competitive oil to Sunicut No. 973 for turning, boring, and threading on the following operation:

Type of Machine: National Acme Gridley Automatic Screw Machine; 2⅜" capacity; Model R.B.; Six Spindles.

Material Machined: Commercial Rod Brass
Operation: ..... Machining Booster Body for Fuse
Speed: ..... 400 Surface-Feet per Minute
Feed: ..... .003"
Lubricant: ..... Sunicut No. 973

With the competitive oil, it was difficult to maintain accuracy of finished parts. Threads were of poor quality, due to chatter-marks. Rejects ran high.

When a Sun Oil Company Engineer was called in, he recommended a change to Sunicut No. 973. Production increased. Accuracy was held to closer tolerances. Chatter-marks were eliminated. Better threads were obtained. Rejects were greatly reduced.

This is just one case taken from the hundreds in Sun's product-performance files. For factual proof of what Sunicut, the clear, transparent, non-emulsifiable cutting oil can do for you, test it in your own plant. Sun Products and Sun Engineering Service are yours to use to improve production. Write . . .

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★ *We make cylindrical plug gauges, cylindrical ring gauges, special flush pin gauges, solid type snap gauges, Master Discs, and built-up gauges.* ★

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Pictured below: Plug Gauge, Ring Gauge, Snap Gauge, Flush Pin Gauge and Built-up Gauge

TRADE PUBLICATIONS

Adhesives—Booklet ADB (61045) about "3-M Adhesives in Industry" illustrates and describes adhesive operations in many different industries, methods of application and a listing of physical properties. Minnesota Mining & Mfg. Co., Adhesives & Coatings Div., 411 Piquette Ave., Detroit 2, Mich.

Adhesives—Booklet of eight pages gives the properties of Pliobond adhesive used for joining fabrics, metal parts, paper, wood, leather and other materials. United States Plywood Corp., Industrial Adhesives Div., 55 W. 44th St., New York 18, N. Y.

Alloys—Leaflet No. 134 is an engineering data sheet about electrical conductivity alloys suitable for resistance welding and kindred uses. Bulletin 64A gives data on aluminum bronze in extruded rods and tubes. Leaflet No. 135 is an engineering data sheet about corrosion-resisting bronzes of many varieties. Ampco Metal, Inc., 1745 S. 38 St., Milwaukee 4, Wis.

Bearings—Part 1, Bearing application is one of a series of three books about the principal ball bearing types and fundamentals of mounting. New Departure, Division of General Motors, 1942 Murden St., Bristol, Conn.

Bearings—Catalog 44, Supplemental die list No. 2, and Bulletin A-45 give information about Oilite bearings and parts, including specifications, shaft clearances, load-carrying capacities, stock sizes of solid and cored bars and finished bearing sizes. Amplex Div., Chrysler Corp., Detroit 31, Mich.

Bearings—Bulletin No. 3 of four pages describes and illustrates the various types of sapphire bearings used for precision instruments, compasses, and meters where unusual performance and durability with little friction is required. Aurele M. Gatti, Inc., 1909 Liberty St., Trenton 9, N. J.

Broaching—Bulletin VMS-45, a four-page folder, describes a standard line of pulldown broaching machines for broaching large and heavy parts for internal work on a production basis. Presents tables of specifications and complete descriptions of machines ranging in size from 3 tons

with a 24-in. stroke to 25 tons with a 60-in. stroke. Colonial Broach Co., P. O. Box 37, Harper Station, Detroit 13, Mich.

Carbide—Catalog No. 45 gives information about all types of tools using cemented carbide products. Illustrations show the many uses of this cutting material. Kennametal, Inc., Latrobe, Pa.

Castings—Form DM-245 is a four-page folder about "Pressure Castings," their solidity and uniformity of structure to resist high pressures. There are suggestions for engineering design. Meehanite Metal Corp., Pershing Square Bldg., New Rochelle, N. Y.

Controls — Bulletin F-2287-1 discusses an electric system of temperature control available for heat ing, ventilating, air-conditioning and industrial applications. Barber-Colman Co., 229 Loomis St., Rockford, Ill.

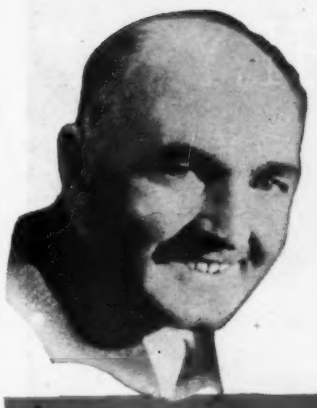
Couplings—Four-page leaflet about Multi-Flex shock-absorbing couplings made in eleven sizes and designed to compensate for angular and parallel misalignment. Their capacities range from 0.15 hp. to 60 hp. at 100 r.p.m. Automatic Machine & Tool Co., 132 Charles St., Auburndale 66, Mass.

Diamonds — 52-page vest pocket booklet about the "Modern Technique for Truing and Dressing with Diamonds" contains important facts on truing and dressing abrasive wheels. Galconda Diamond Products Corp., 3418-24 N. Knox Ave., Chicago 41, Ill.

Drilling—Six-page folder describes and illustrates the Quadrill and Quadtapper which is an attachment to a drill press capable of being indexed to any one of four positions for drilling or tapping holes and can be used for reaming holes. Chicago Drillet Corp., 922 S. Michigan Ave., Chicago 5, Ill.

Electronics—48-page catalog lists tools and equipment available. Tools, tubes, condensers, rheostats, lamps, instruments, transformers are among the items listed. Walker-Jimieson, Inc., 311 South Western Ave., Chicago 12, Ill.

Enamel—A booklet describing characteristics of and applications for porcelain enamel, tells how it is made and its application to metal



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When you use the new Ellstrom round gage blocks, practically all of the gaging surface can be utilized because there are no corners, as in the case of the square blocks. For example, the gaging area of a round block is .9970 square inch while the gaging area of a square block is .7917 square inch. Gage life is thereby increased.

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Set No. 2-81-1	656.25
Set No. 2-35-W	222.50
Set No. 2-35-1	318.75
Set No. 2-36-W	259.35
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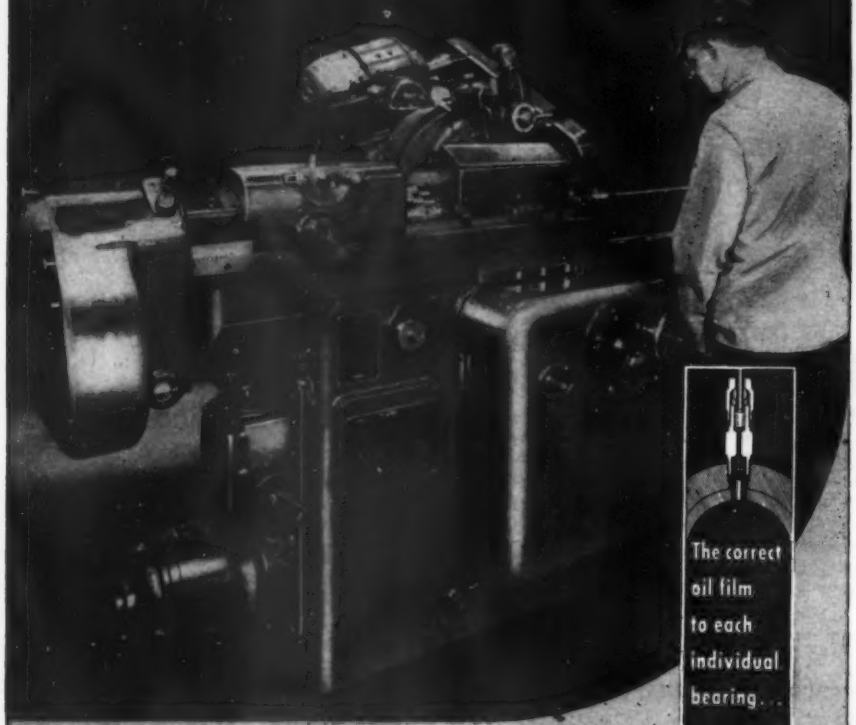

"JONES & LAMSON" Automatic Thread Grinder . . . with all bearings except grinding wheel spindle Bijur-lubricated.

● No time is lost from productive work . . . a BIJUR-equipped machine oils itself, while running! Metered oil-feed—the correct oil-film needed by each individual bearing—is supplied automatically. The efficiency of operator and machine is raised . . . precision standards are held . . . maintenance is reduced to a minimum . . . production stepped up!

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parts. Porcelain Enamel Institute, Inc., 1010 Vermont Ave., N.W., Washington 5, D. C.

Filter—Circular describes a clarifier for the centrifugal cleaning of coolant to free it of chips and disagreeable odors. W. R. Carnes Co., 2066 Helena St., Madison 4, Wis.

Furnace—Bulletin No. SC-125 describes a controlled gas-atmosphere furnace which prevents decarburization of the skin of various carbon and alloy steels. Surface Combustion Corp., Grover & Sherman Sts., Toledo 1, Ohio.

Gears—Bulletin No. T-45 is a convenient table for computing change gears for hobbing helical gears. There is an explanation of how to obtain exact size measurements of external and internal helical involute gears by the so-called "ball method." Technical Bulletin No. 1130-45 describes a base pitch and tooth spacing checking machine (Model 1130) which will handle spur and helical gears, splines and worm wheels up to 12 in. O.D. and a maximum shaft length of 18 in. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

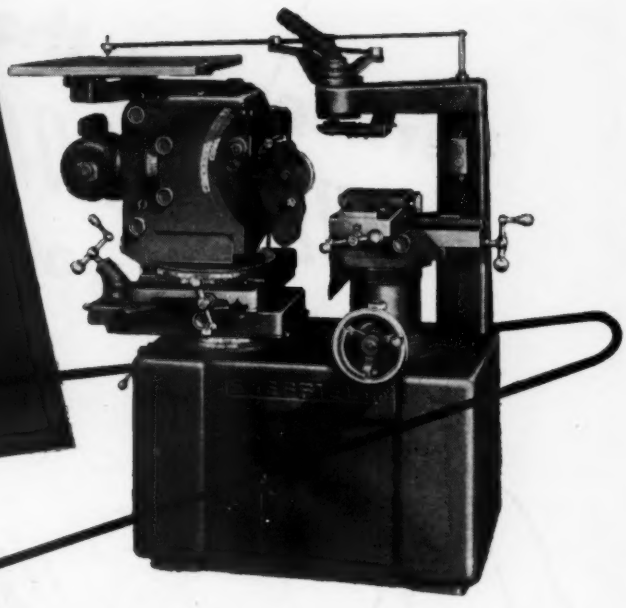
Grinding — An 8-page booklet "Grinding and Finishing With Idler Backstands" presents complete engineering and production data about latest methods for speeding up grinding and finishing operations by converting to coated abrasive belts. Behr-Manning, 1933 Sidford St., Albany, N. Y.

Grinding—12-page booklet: "Faster, Better Finishing of Metal, Plastic and Glass" describes the 3-M "Wet-ordry" method of precision grinding and finishing at high speeds. Minnesota Mining & Manufacturing Co., Halpin & Camp Sts., St. Paul 6, Minn.

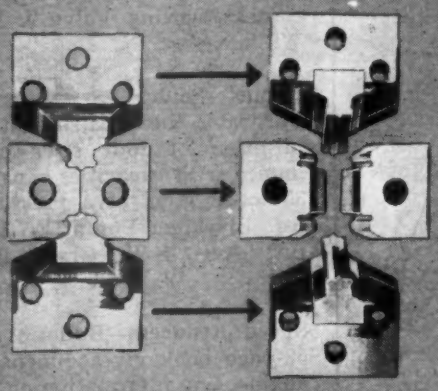
Grinding—Folder describes and illustrates grinding wheel accessories for portable tools to fit well known air and electric powered and flexible shaft machines. American Emery Wheel Works, 1 Richmond Sq., Providence, R. I.

Inspection—Leaflet about "Magni-Ray" which is a magnifying glass, mounted on an adjustable stand behind which are electric lights to flood the surface under observation. George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y.

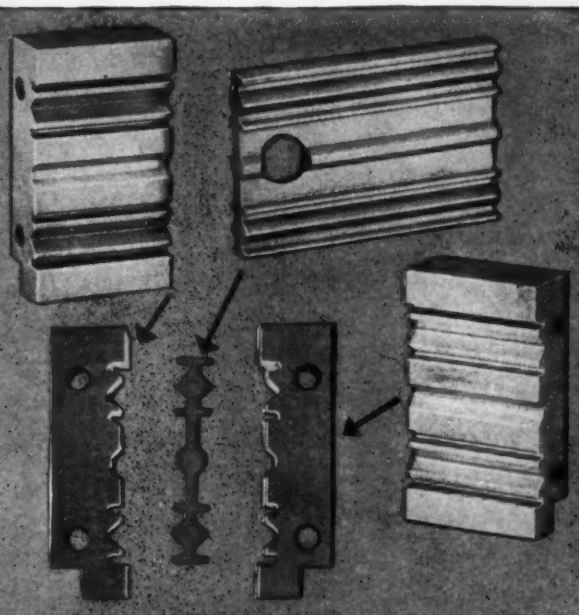
In Half the Time



MICRO-FORM GRINDER



If you are grinding punches and dies to close tolerances, you will be interested in the following performance figures. Herewith is illustrated two punches and a pair of matching die halves for producing the notched forms at the ends of a standard razor blade blank. Each punch is ground in 6 hours and the die halves, with closely specified clearance angles, are ground in 6 hours apiece.



Shown here are a die set—a punch and two die halves for slotting razor blade blanks—a difficult, precise grinding job. The punch, about 2 inches long, is ground from a roughed-out heat treated blank in just 16 hours including all alignment and checking. The two matching die halves are ground in 8 hours each (floor-to-floor).

write for booklet M-120-144 telling how to grind profiles direct from the drawing faster and at lower cost.

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BUT A LAMINUM SHIM doesn't stop there. You get *certainty* of accuracy in factory assembly of gears and bearings of all kinds (with less supervision) plus the ease with which adjustments in service may be made with the same Laminum shim. Advantages too great to be minimized. Bulletin and application photo chart on request.

Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

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THE SOLID SHIM THAT peels FOR ADJUSTMENT

Metal Spinning—Data Book No. 2 of 32 pages shows many types of metal product produced by spinning ferrous and non-ferrous sheets. The process is illustrated and described. Milwaukee Metal Spinning Co., 1327 S. 43 St., Milwaukee 14, Wis.

Motors—Bulletin No. 507 describes the construction cf Pilot motors and centrifugal blowers used for cooling radio and other electronic equipment, forced draft, air distribution in confined spaces, and exhausting fumes and gases. F. A. Smith Manufacturing Co., P. O. Box 509, Rochester 2, N. Y.

Oxygen—Booklet No. ADG-2014 of 24 pages about "Oxygen — Indispensable Servant of Industry," describes hand and mechanical welding and cutting, cleaning, underwater cutting and other flame processes. Air Reduction Sales Co., 60 E. 42 St., New York 17, N. Y.

Packing—8-page bulletin describes the application of Darcova Pumcups for packing air and hydraulic cylinder pistons in a variety of machines. Darling Valve & Mfg. Co., Williamsport, Pa.

Pumps—Folder PS-1 describes and illustrates the construction and application of four sizes of rotary pumps with capacities ranging from 35 to 90 gpm. at a pressure of 45 psi. Blackmer Pump Co., 1901 Century Ave., S.W., Grand Rapids 9, Mich.

Speed Reducers—Bulletin MR-45 a 52-page book gives dimensions and engineering information on horizontal and vertical motor reducers. Philadelphia Gear Works, Inc., Erie Ave. & G St., Philadelphia 34, Pa.

Relays—Catalog No. 10 of 56 pages illustrates and describes many types of relays, solenoids, thermostats, contactors and switchparts. The Guardian Electric Mfg. Co., 1400 W. Washington Blvd., Chicago 7, Ill.

Retaining Rings—Bulletin 3 of 6 pages describes special types of Lomarc retainers and tools for servicing these rings. Waldes-Koh-I-Noor, Inc., 47-10 Austel Pl., Long Island City 1, N. Y.

Screws—A 14-page catalog giving list prices and weights of all types of Phillips recessed head and standard machine screws. The Milford Rivet & Machine Co., 1000 Merwin Rd., Milford, Conn.

Shafting—A ten-page book describes and illustrates flexible shafting for the transmission of power. Lear Incorporated, Piqua, Ohio.

Steel—A four-page folder form No. 434 about a group of low alloy, high tensile steels gives general characteristics, chemical composition and physical properties of Aldecor, Cor-Ten, and Double Strength Steels; these are offered for modern lightweight design of mobile structures. Republic Steel Corp., 3100 E. 45 St., Cleveland 4, Ohio.

Steel—A 24-page booklet describes the advantages of low-alloy high-strength steels 50Y and 55Y with minimum yield strengths of 50,000 and 55,000 psi. for use in railway cars, trucks, buses and aircraft parts. The chemical and physical properties are listed, and the welding properties are given along with design information. The American Rolling Mill Co., 119 Curtiss St., Middletown, Ohio.

Tachometers—GEA-4324. They consist of a generator and an instrument and are used to measure rotational speeds from 1 to 60,000 r.p.m. General Electric Co., Schenectady, N. Y.

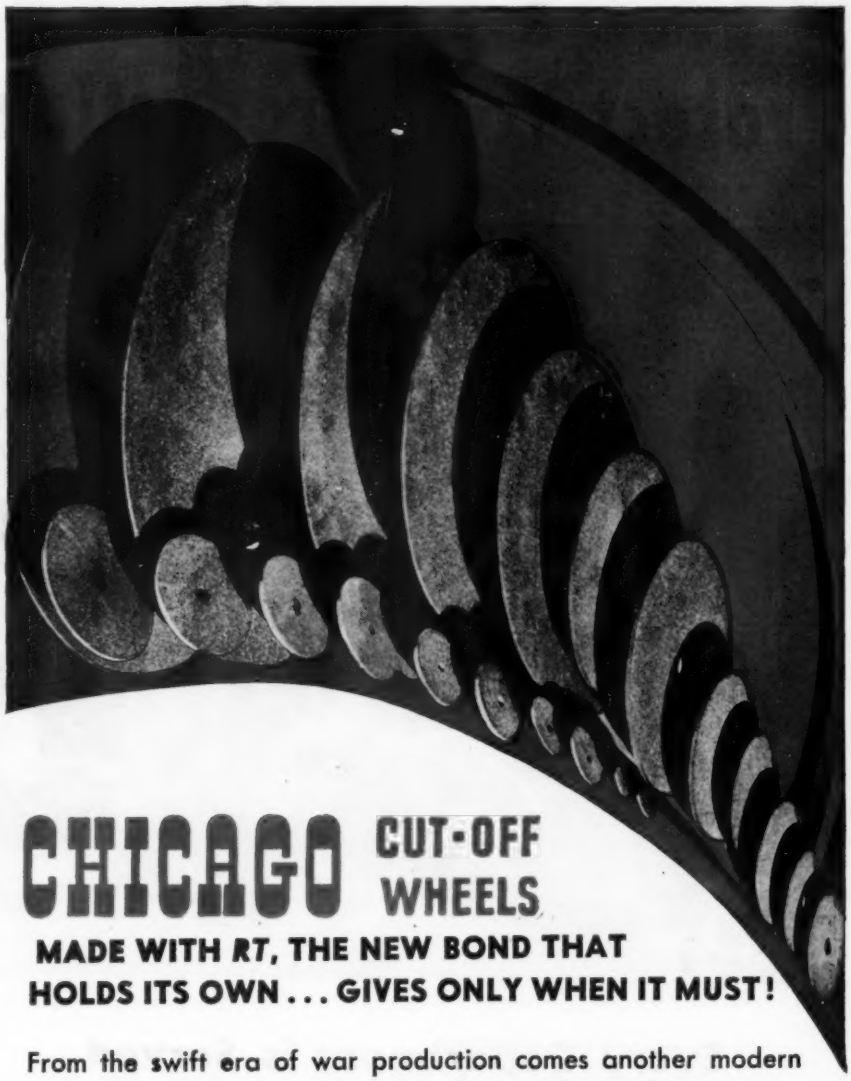
Tubing—A 4-page leaflet containing purchasing data about seamless alloy steel aircraft tubing containing definitions and specifications. The Seamless Steel Tube Institute, Gulf Bldg., Pittsburgh, Pa.

Tubing—Catalog of 14 pages gives the weights, outside diameters and thicknesses from 1/16 in. to 10¾ in. outside diameter by BWG, fractional or decimal wall thicknesses. Michigan Seamless Steel Tube Co., South Lyon, Mich.

Universal Joint—Bulletin 45 illustrates a link-type universal joint which permits operation of shafts around bends up to 90 deg. without backlash. Piezoelectric Corp., 110 E. 42 St., New York 17, N. Y.

Vibration—Bulletin 425 shows a 25-lb. capacity machine for subjecting mechanical and electrical equipment to the effect of vibration upon service life without maintenance and breakdown. All American Tool & Mfg. Co., 1014 Fullerton Ave., Chicago 14, Ill.

Vibration—Catalog SP650 of 6 pages "Vibration in Industry" shows methods of mounting machines so that



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From the swift era of war production comes another modern miracle, the cut-off wheel—man power and man hour saver—for the fastest, smoothest method of cutting tubing, wire, steel and brass sheets, glass, porcelain, Stellite, tungsten, plastics, laminates and other hard-to-slice materials.

When RT, the special formula bond was developed, it put the cool-running CHICAGOS 'way out in front in real performance records.

Available in rubber or resinoid—a full range of styles and sizes. 3 bond types—for every operation.

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When your Ryerson alloy steels arrive, complete test data comes with them—data that enables engineers and designers to call for the physical properties listed, with confidence that they can be secured—that furnishes heat treaters with a guide to sure, accurate results and provides a detailed record for your purchasing executive.

As a part of the Ryerson Certified Steel Plan, this data is developed from actual laboratory tests. In addition to mill tests for chemical analysis and physical characteristics, Ryerson subjects samples from each alloy heat to four end-quench hardenability tests. From hardness readings of the test samples we interpret obtainable physical properties for various size rounds in the as-quenched condition and when quenched and drawn at 1000°, 1100° and 1200° F.

This test data comes with alloys which are identified by heat symbol as well as by color marking. And to make doubly certain that you get the right steel Ryerson checks against mixed shipments by spark testing all alloys in stock.

Ryerson alloy service costs you nothing extra. It protects your products and production. It saves time and money. It is furnished by 11 Ryerson Steel-Service Plants, each located in a major industrial area. The Ryerson alloy plan is explained in detail in our booklet "Interpreting Hardenability." If you did not receive a copy write today. And get in touch with your nearest Ryerson plant when you need alloy steel from stock.

Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston

RYERSON STEEL-SERVICE

their vibrations will not be transmitted to the building or other machinery. The Korfund Co., Inc., 48-15 32 Place, Long Island City 1, N. Y.

Welding—Bulletin W-2 of 20 pages about "Ampco-Trade Welding Technique" describes the methods to be employed for welding or building up various types of bronzes by the use of a carbon arc with the proper filler rod, or the heat of an oxyacetylene flame and a filler rod. Ampco Metal, Inc., 1745 S. 38 St., Milwaukee 4, Wis.

Welder—Catalog 44-B describes a stud welder for hand use arranged to hold the stud perpendicular to the surface. Nelson Specialty Welding Equipment Corp., San Leandro. Calif.

NEW BOOKS

MANAGEMENT OF INSPECTION AND QUALITY CONTROL. *By J. M. Juran, formerly chief of inspection control division, Western Electric Company, 233 pages. Published by Harper & Brothers, 49 East 33 St., New York, N. Y. Price $3.*

Very likely, the inspection function will become increasingly important in the postwar era. Even before the war, non-military products showed a tendency toward greater precision and uniformity, longer life and stability, and this trend has been accelerated during the war. The importance of adequate inspection has been learned and the experience so gained will definitely be used to reduce costs and insure continued acceptance of products by postwar consumers.

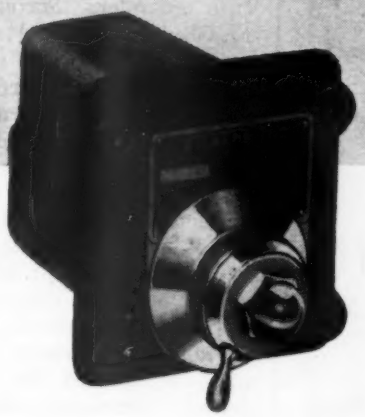
Inspection equipment and process-control techniques have kept pace with requirements, but it is questionable whether the management of inspection and quality control has kept abreast. This function must be so integrated with other shop functions that it can adequately perform its role. And there is no reason to believe that the principles can not be intelligently applied in small as well as large plants.

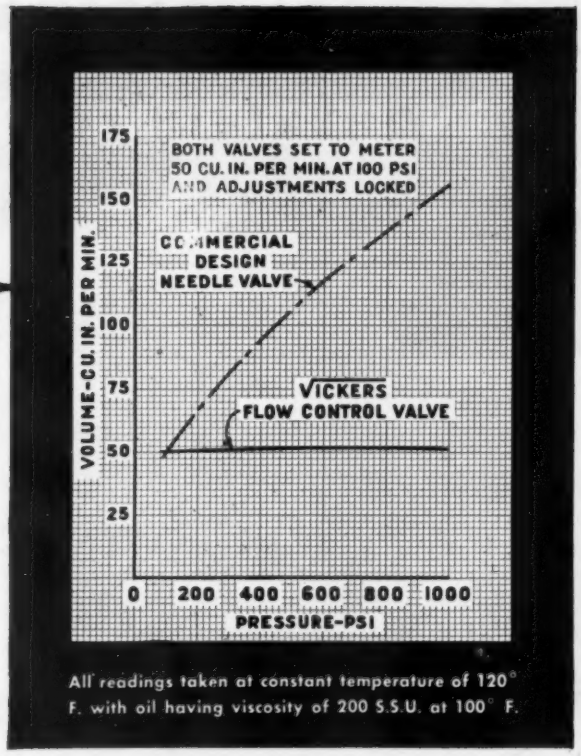
In covering the subject in a broad way, the author discusses: quality specifications, measurement, accuracy of inspectors, acceptance sampling, control sampling, lines of inspection authority in the plant, line

CONSTANT FLOW RATE

Regardless of

VARIATIONS IN FLUID PRESSURE





All readings taken at constant temperature of 120° F. with oil having viscosity of 200 S.S.U. at 100° F.

As shown by test chart at right, the Vickers Flow Control Valve maintains a practically constant metering rate (for a given setting of the control adjustment) regardless of variation in fluid pressure. This ability to accurately control the rate of travel of tool head or slide . . . or the rpm of a hydraulically driven work spindle . . . at all times regardless of the resistance encountered is a fundamental requirement of many types of machine tools and special machinery. The absence of a hesitation, jump or a speed variation with a load change is important because these nearly always are detrimental to tool life, work finish or proper operation. Tool damage when "breaking through" work is eliminated and variations in cut or operating pressure have no appreciable effect upon feed rate. See Bulletin 40-15 for complete information.

Vickers Application Engineers will gladly discuss with you how "hydraulics" can be used to your advantage.

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Adjustable FLOW CONTROL VALVES

VICKERS *Incorporated*

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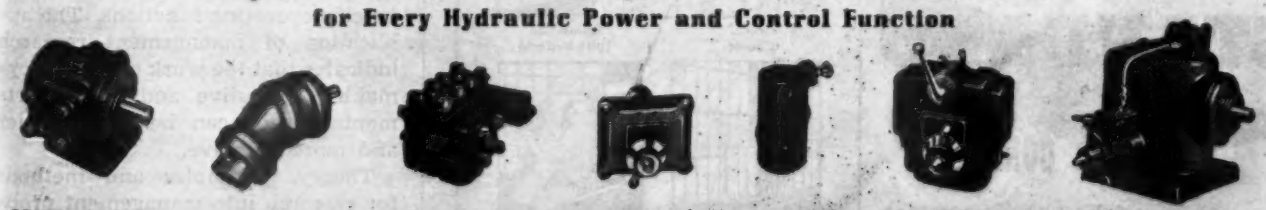
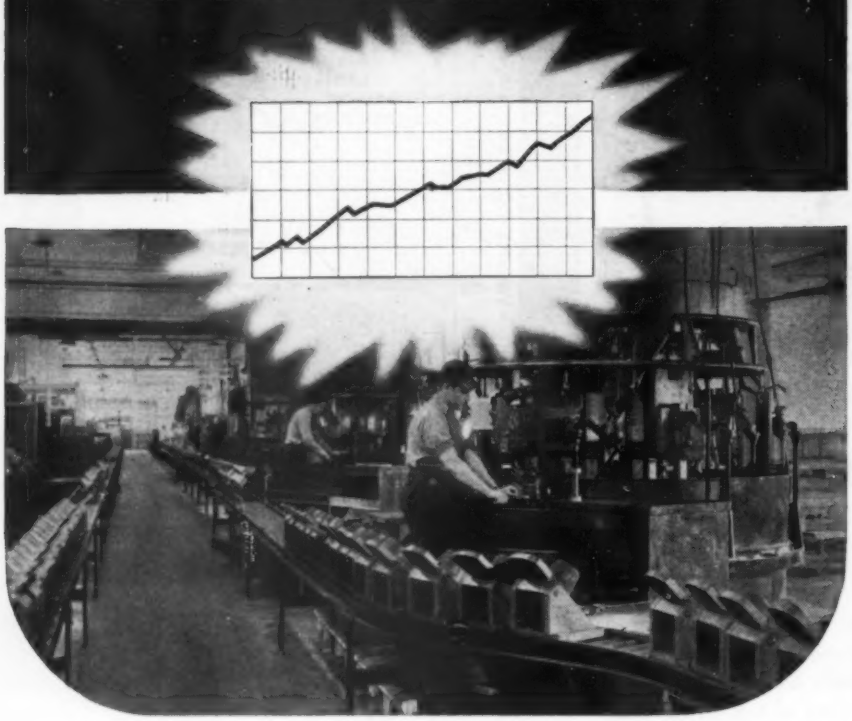


CONSTANT DELIVERY PUMPS | FLUID MOTORS | DIRECTIONAL CONTROLS | VOLUME CONTROLS | PRESSURE CONTROLS | CONTROL ASSEMBLIES | VARIABLE DELIVERY PUMPS

AN ORDERLY CONVEYOR-COORDINATED PLANT BESPEAKS AN EFFICIENT PLANT!



PRODUCTION processes coordinated and synchronized with conveyors assure a clean, orderly, efficient plant.

Conveyors break the bottle-necks that cause confusion, congestion, loss of productive man-hours, reduced output. They channel the flow of material and products in process—work flows smoothly without halt or interruption and with the least manual hauling.

Make the most of your productive time—manpower—space—investigate all the things conveyors can do—the many ways they can earn money for you.

Standard builds roller, belt, chain, slat, push-bar, power and gravity conveyors, spiral chutes, portable pilers, pneumatic tube systems. Standard Conveyor Company is equipped by experience and facilities to make yours a conveyor coordinated plant. Write for valuable reference book "Conveyors by Standard," Catalog No. AM-95.

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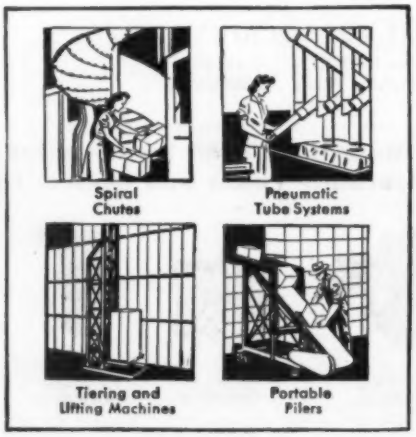

inspection functions, optional inspection functions, inspection staff functions, top management controls of the inspection department, quality-mindedness, and introducing a system of modern quality-control techniques.

NEW BOOKS

CAST IRON IN THE CHEMICAL AND PROCESS INDUSTRIES. *By F. L. La Que. 27 pages. Published by the Gray Iron Founders' Society, Cleveland 13, Ohio. Price $1.*

Extensive data on corrosion rates of cast iron exposed to action of substances commonly handled by chemical equipment are provided by the author, who is head of the corrosion-engineering section of the International Nickel Company. Results of tests are given for more than 300 corrosive media, ranging from acetic acid to zinc sulphate. Corrosion-resisting characteristics of gray iron may be altered by alloying and foundry techniques, since both affect the size, shape and distribution of graphite particles and influence the corrodibility of the matrix. In regard to the corrosive-service-per-dollar factor, the booklet states that in some applications the nature of the corrosive media is such that, despite a fairly rapid attack on the cast iron, no other material can be expected to render long enough service to justify a higher initial cost.

•

PRACTICAL MANAGEMENT RESEARCH—*By Alexis R. Wiren and Carl Heyel, 222 pages. Published by McGraw-Hill Book Company, 330 West 42 Street, New York 18, N. Y. Price $2.50.*

The importance of human relations is emphasized in this treatment of scientific research techniques as applied to management. The book is concerned with the application of research principles to general management problems as well as to specific operating functions. The application of management research indicates that the work of the policy-making executive and his departmental heads can be made easier and more effective.

Theory, principles and methods for research into management problems are given in detail in this "engineering" approach.

SAVE THESE FOR WORK A MACHINE CAN'T DO

Here is work a machine CAN do

HC—5—½ H.P., multi-speed countershaft unit, 900 to 3600 R.P.M. Mounted bench-height on 3-leg caster base, 360° swivel.

Grinding—Sanding—Rotary filing—Wire brushing—Buffing and Polishing—all are machine operations. There are many more.

All can be done better and faster, with a greater degree of efficiency, by using a Haskins Flexible Shaft Machine. And this with much less strain and fatigue on the part of the operator.

Write for Catalog 45, showing many ways to speed production with flexible shaft equipment. And remember—save your hands for work a machine *can't* do.

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FLEXIBLE SHAFT EQUIPMENT

DAMAGE EXPELLER!

While using slotted screws, work-spoiling driver skids were causing frequent damage to plastic shades in the assembly of desk lamps. Refinishing slowed down production, and spoilage boosted costs . . . until the manufacturer started using Phillips Recessed Head Screws.

OUTPUT IMPELLER!

With the change to Phillips Screws, damage and delays were eliminated. And with no more worry about driver skids, power drivers could be used, speeding output further. Costs came tumbling down . . . production set new records.

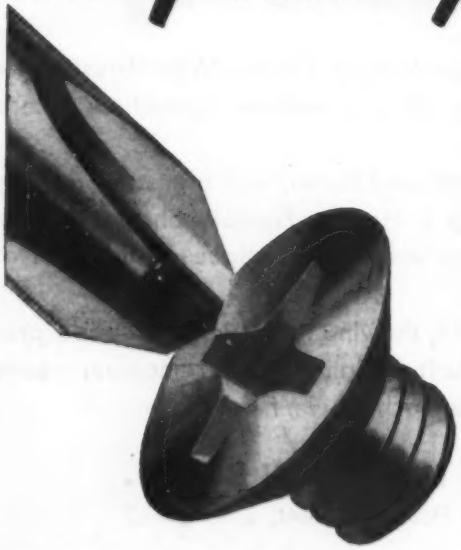
PROBLEM DISPELLER!

Phillips Recessed Head Screws, engineered to take heavier driving pressures, simplify product design, give it more strength, more rigidity . . . often with the use of fewer screws. Screw-driving is faster, easier, surer . . . permits design innovations slotted screws just can't touch.

SALES PROPELLER!

The Phillips Recessed Head radiates quality. It's trimmer . . . smarter looking . . . modern as tomorrow. No unsightly burrs and uneven appearance to cool off interested prospects. Put the extra sales push of Phillips Screws behind your product . . . make *good* merchandise look *better!*

It's Phillips — the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

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Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
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Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
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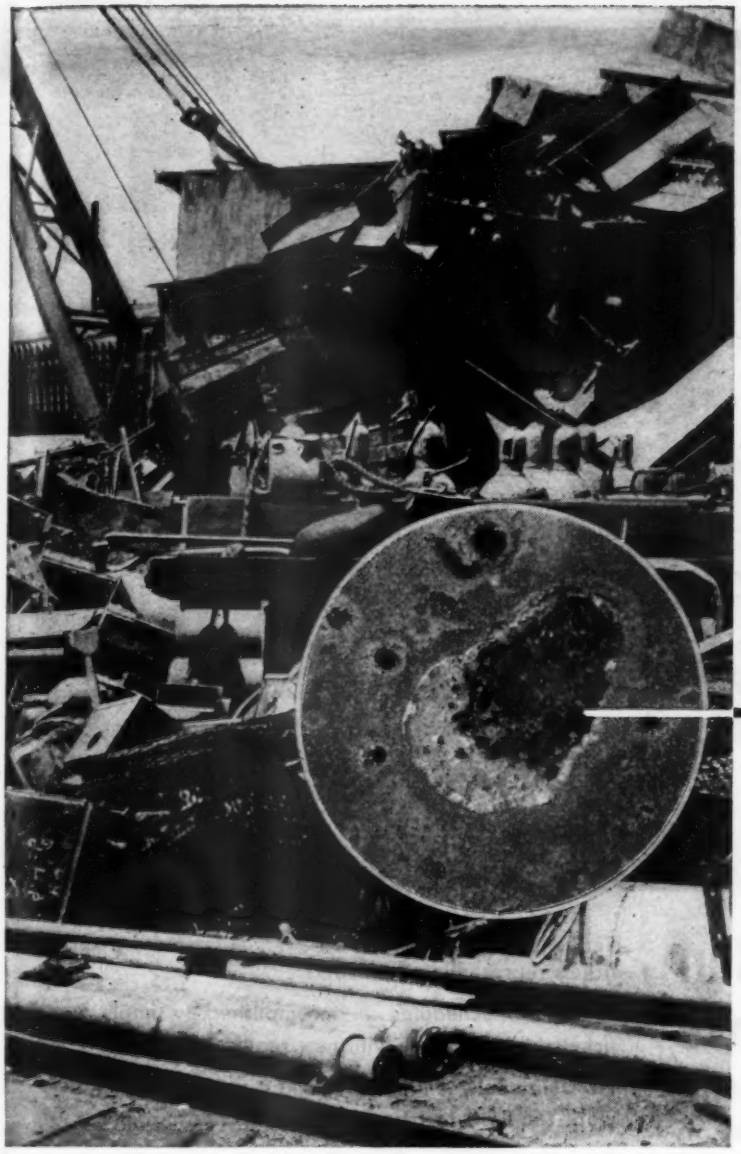

You don't need to put up with —RUST

RUST COSTS AMERICAN INDUSTRY WELL OVER $100,000,000 A YEAR!

How much of that sum could you save if rust were eliminated in your plant?

Cities Service Anti-Corrode and Cities Service Rust Remover quickly and safely effect substantial savings...help insure your production.

Cities Service Rust Remover wipes metals clear of rust or tarnish formations. Easy to apply—acts quickly and effectively.

Cities Service Anti-Corrodes *prevent* rust . . . provide safe and durable protection against rust or corrosion. There is a specific Anti-Corrode for every industrial need.

Talk over your rust problems with a Cities Service lubrication engineer and let him suggest methods for their solution. You will benefit immeasurably from his expert knowledge of the subject. Write now or mail the coupon below.

Rust can be *eliminated*...and Cities Service can *help* you.

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Gentlemen: Please send full information on Cities Service Rust Prevention Program.

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ONCE-ALWAYS

One-Form Dispatch Plan Keeps Work on the Move

A fool-proof machine control system, well received by employees and management alike, is described by Mr. R. M. Toppin, Production Manager of The Jacobs Manufacturing Company, Hartford, Conn. in the July 1945 issue of Factory Management and Maintenance. This system, by McCaskey, provides machine control with one four-copy production form. Because of space limitations, we suggest only a few of the many advantages and economies that are described:

Visual Scheduling . . . a glance at the board gives a picture of the work ahead.

Sequence of Orders Ahead . . . indicated by sorting of tickets representing the orders.

Changes in Schedules . . . accomplished by simply re-sorting tickets in accordance with new requirements.

No Delay Between Planning and Dispatching . . . no clerical work required to transfer planning information.

Smooth Operation According to Plan . . . this is assured even though foreman is called away by other responsibilities. Frequent interruptions by set-up men and operators looking for work are eliminated by brief daily planning.

Subordinates Readily Trained and Functions Delegated . . . simplicity and visibility of whole procedure enables foremen to maintain close supervision of dispatching.

Operators Cooperate Freely . . . in keeping production counts accurate, as shown by comparison of accumulated totals with actual counts.

Accuracy of Records and Reports . . . on costs, efficiency and progress guaranteed.

For full information on how these results were achieved, write for a copy of four-page reprint of the complete article, "One-Form Dispatch Plan Keeps Work on the Move."

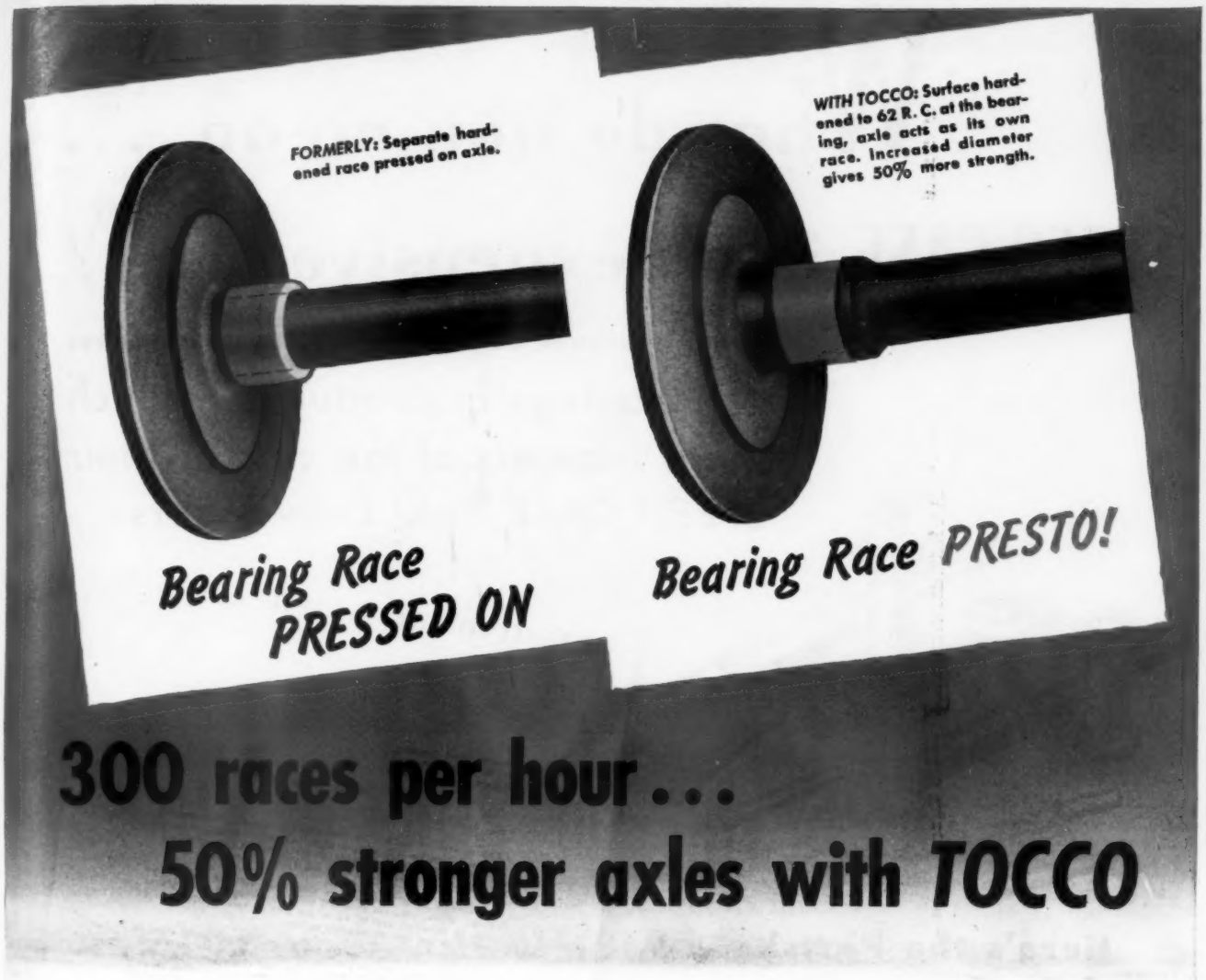
THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

A-735

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL


FORMERLY: Separate hardened race pressed on axle.
WITH TOCCO: Surface hardened to 62 R. C. at the bearing, axle acts as its own race. Increased diameter gives 50% more strength.
Bearing Race PRESSED ON
Bearing Race PRESTO!

300 races per hour... 50% stronger axles with TOCCO

AXLE shafts can serve as their own bearing races when the surface is given superhardness by TOCCO Electrical Induction. This eliminates the separate inner bearing race formerly pressed on . . . and by increasing the axle diameter at the bearing gives 50% more strength.

One TOCCO installation, hardening 300 axle bearings per machine per hour, has paid for itself from savings within a few months. The high quality of results is attested by millions of these axles now in service.

For YOUR Problem. This technique for producing integral bearing races can be applied to machine parts of many types and sizes . . . to quicken your race to market and to give you better products at lower cost. TOCCO simplifies reconversion these ways: Cuts heating time to seconds; eliminates straightening, scale cleaning and other operations; banishes rejects; enables you to spot heat-treating in the production line; gives you 100% uniformity of results with unskilled operators.

Enlist the TOCCO Engineer in *your* reconversion plans. No obligation. Write for free booklet, "Results with TOCCO".

THE OHIO CRANKSHAFT COMPANY · Cleveland 1, Ohio

TOCCO

INDUCTION

HARDENING, BRAZING

ANNEALING, HEATING

What do you mean ....

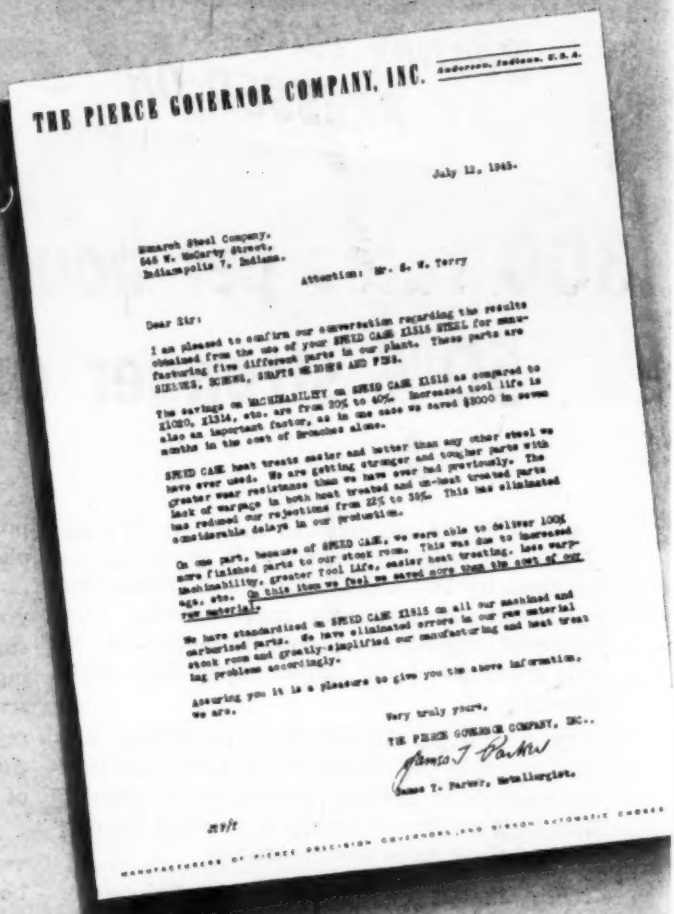
"SPEED CASE is an expensive steel"?

PIERCE GOVERNOR CO., INC., ANDERSON, IND., REPORTS

☆ *Savings in production which more than equal the cost of their SPEED CASE Cold Drawn Bars...*

Here's the Parts! Read the Facts!

- Five different parts made from Speed Case Steel—sleeves, screws, shafts, weights, and pins ... VERSATILITY!
- Savings over X1020, X1314, etc. = 20 to 40%.
- $2,000 saved in 7 months Broaching cost.
- Treats easier and better than any other steel ever used. Stronger—tougher—longer wearing parts than ever before. Warpage rejections reduced 22 to 35%—speeded up production.
- Speed Case increased production on one part 100%!
- They have STANDARDIZED on Speed Case X1515 for all machined and carburized parts.



THE PIERCE GOVERNOR COMPANY, INC. Anderson, Indiana, U.S.A.

July 12, 1945.

Monarch Steel Company,
845 W. McCarty Street,
Indianapolis 7, Indiana.

Attention: Mr. S. W. Terry

Dear Sir:

I am pleased to confirm our conversation regarding the results obtained from the use of your SPEED CASE X1515 STEEL for manufacturing five different parts in our plant. These parts are SLEEVES, SCREWS, SHAFTS WEIGHTS AND PINS.

The savings on MACHINABILITY on SPEED CASE X1515 as compared to X1020, X1314, etc. are from 20% to 40%. Increased tool life is also an important factor, as in one case we saved $2000 in seven months in the cost of Broaches alone.

SPEED CASE heat treats easier and better than any other steel we have ever used. We are getting stronger and tougher parts with greater wear resistance than we have ever had previously. The lack of warpage in both heat treated and un-heat treated parts has reduced our rejections from 22% to 35%. This has eliminated considerable delays in our production.

On one part, because of SPEED CASE, we were able to deliver 100% more finished parts to our stock room. This was due to increased machinability, greater tool life, easier heat treating, less warpage, etc. On this item we feel we saved more than the cost of our raw material.

We have standardized on SPEED CASE X1515 on all our machined and carburized parts. We have eliminated errors in our raw material stock room and greatly simplified our manufacturing and heat treating problems accordingly.

Assuring you it is a pleasure to give you the above information, we are,

Very truly yours,

THE PIERCE GOVERNOR COMPANY, INC.,

James T. Parker

James T. Parker, Metallurgist.

mr/t

manufacturers of pierce precision governors and pierce automatic chokes

Write for SPEED CASE and SPEED TREAT CATALOG
Our Metallurgists are at your service

Licensee for Eastern States

THE FITZSIMONS COMPANY

YOUNGSTOWN, OHIO

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

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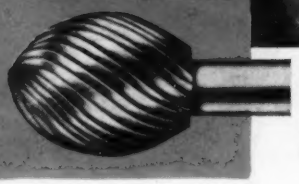
"CLEAN EARS" in a jiffy



Flame Shape Ground Rotary File used in clearing fillets of cast pump impeller.

ROTARY filing solves many production problems in getting at places otherwise difficult to reach. Die sinking, metal pattern making, tool making, mold finishing, and the finishing of small and intricate parts frequently present such problems.

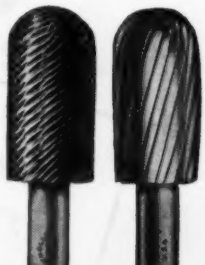
In such work, rotary files are extensively used for breaking and chamfering corners, removing burs and fins, cleaning, enlarging and elongating holes and slots; also for removing scale from aluminum, brass, bronze and iron castings.

It is fitting that Nicholson's vast experience in file making should become of service to industry in connection with rotary as well as other types of files. You may be sure that Nicholson Rotary Files will always be of the highest quality standard and that the Nicholson recommendations will be earnest and unbiased.

WRITE FOR CATALOG AND PRICE LIST

—and for any special information you desire. For deliveries, consult your mill-supply house.

NICHOLSON SELLS BOTH HAND CUT AND GROUND *types of Rotary Files—each in 16 standard styles or shapes; in 3 cuts (Coarse, Medium and Fine); in diameters of 1/8" to 2".*



HAND CUT GROUND

NICHOLSON FILE CO. • 97 ACORN STREET, PROVIDENCE 1, R. I.

(In Canada, Port Hope, Ont.)

NICHOLSON ROTARY FILES

HAND CUT and GROUND

FOR EVERY PURPOSE

NICHOLSON U.S.A.

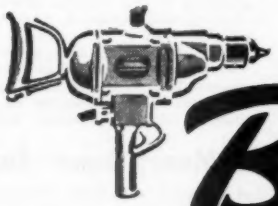
Gives Rust–
BLACK & DECKER
7" Heavy Duty
Sander
$65
7" Standard . . . $53
9" Heavy Duty . . . $75

This Versatile Black & Decker Tool Cleans Up Dirty Jobs in a Jiffy!

Yes, you can clean up many kinds of work with a Black & Decker 7" Heavy Duty Sander. For example, it drives wire cup brushes for such jobs as removing old paint, rust and scale; cleaning castings, structural metal, tanks and boat hulls. (And don't forget that *Black & Decker* Wire Cup Brushes—engineered and made in our own plant for high speed work—are definitely better, tougher, stand up longer on cleaning jobs of every kind.)

Getting back to the Sander, the same tool drives two types of grinding wheels, for everything from grinding welds and casting ridges to surfacing concrete, stone or tile. It drives rotary gouging and planing heads for shaping and semi-finishing lumber. It drives 19 different kinds of abrasive discs for sanding and smoothing any surface.

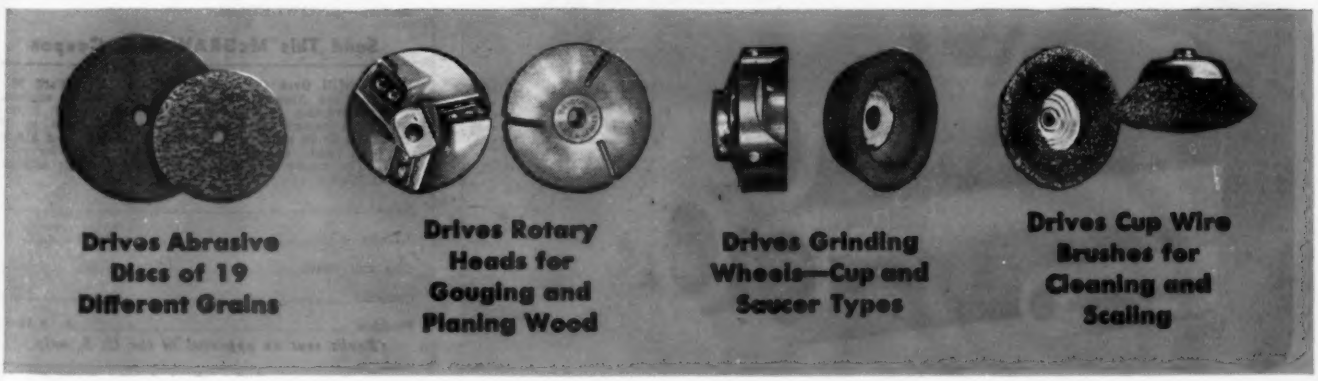
For a copy of our complete catalog of more than 100 different Black & Decker Electric Tools and over 1,000 attachments, write to: The Black & Decker Mfg. Co., 616 Pennsylvania Ave., Towson 4, Maryland. For help on any tooling problem, call your nearby Black & Decker Distributor.



LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS


Drives Abrasive Discs of 19 Different Grains
Drives Rotary Heads for Gouging and Planing Wood
Drives Grinding Wheels—Cup and Saucer Types
Drives Cup Wire Brushes for Cleaning and Scaling

Ampcoloy

continuous cast rods and tubes of bearing bronze

Cut Costs 4 ways!

Because the continuous casting process results in rods and tubes of close tolerance and soundness and gives you a fine, even dispersal of lead and other secondary constituents, you benefit through four important production economies. (1) Your scrap loss due to metal faults is practically eliminated. (2) Your tools last longer because of a sand-free surface and no internal segregation. (3) You get faster production on screw machines, with big savings in time, manpower, and money. (4) You get further savings due to the relatively small amount of handling and storing scrap accumulation.

If the successful operation of your product depends on bronze with excellent bearing characteristics, your good judgment will tell you to investigate the merits and economies of Ampcoloy continuous cast rods and tubes of bearing bronze.

The sale of continuous cast products as applied to forms to be machined or used "as cast" is exclusive with Ampco. Available in a variety of alloys. Write for data sheet 131 showing photomicrographs and properties. *Ampco Metal, Inc., Dept. 4-M-9, Milwaukee 4, Wisconsin. Ampco Field Offices in Principal Cities.*

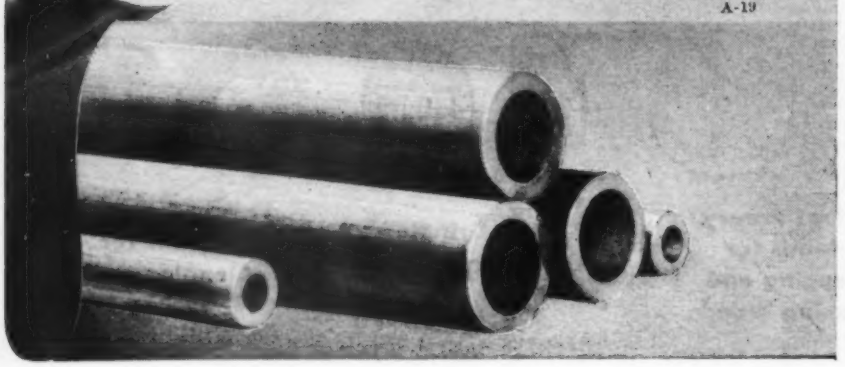
AMPCO

Ampcoloys are a product of

Ampco Metal, Inc.

—specialists in engineering — production — finishing of copper-base alloy parts.

A-19



The set of books that makes

MASTER MACHINISTS

and leads to bigger pay!

This big home-study and reference course gives you the practical facts on machines and methods you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency with

AMERICAN MACHINISTS' LIBRARY

6 volumes, 2516 pages, 2368 illustrations, many charts and tables

THESE books answer your questions on methods and machines—tell what you need to know about the operation of machines of all types and sizes for the whole range of metal cutting, forming, and finishing operations—show by text, diagram, and illustration the essential points of setting up work, adjusting machines, selecting feeds and speeds, determining pressures, handling materials, devising short-cuts, etc.

What the Library gives you

—complete guide for everybody, from shop executive to apprentices, interested in the operation of machines used in turning and boring practice
—description of all important varieties of machines, both manual and automatic, and methods of operating them
—data on speeds and feeds, new cutting alloys and materials, use of coolants, etc.
—practical information on grinding machines and abrasive wheels, showing what they do, how to operate them, and how to make best use of them on various types of work
—training in the various operations performed in drilling and surfacing materials in the machine shop
—exact, descriptive data on all aspects of gear-cutting practice, useful in shops of any size
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Send me the American Machinists' Library, 6 volumes, charges prepaid, for 10 days' examination. If I find the books satisfactory, I will send you $1.50 in 10 days, and $3.00 a month until the special price of $19.50 has been paid. Otherwise I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

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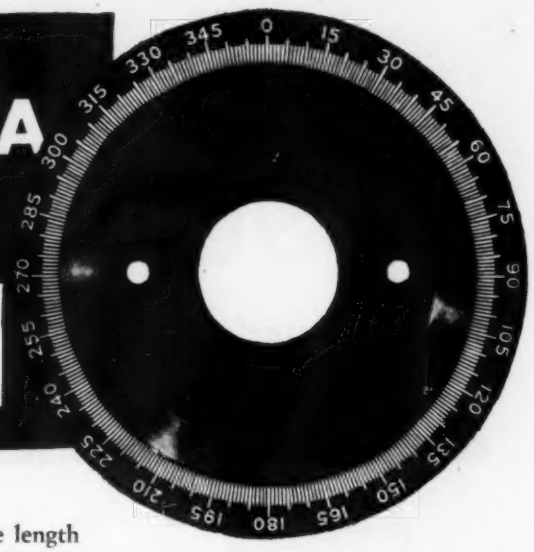
(Books sent on approval in the U. S. only.)

MACHINING DATA ON PLASTICS

9. BRANDING

(PART TWO OF THREE PARTS)



This is the ninth in a series of messages designed to better your knowledge of the phenolics —the most versatile of all plastics... the type of plastics which Durez has specialized in producing for the past quarter century.

The branding method of marking a molded plastic part is a process which is a combination of burning and molding into the surface. A steel die under carefully controlled heat and pressure will produce clear, sharp, permanent markings to an average depth of .010".

Heat and Pressure Required

Molded phenolic plastics, being of a thermosetting nature and possessing a very hard surface, require much higher branding temperatures than thermoplastic materials, which can be branded at temperatures as low as 300° F. The average temperature range for the various types of phenolic materials is as follows: Rag-filled and laminated—600° F.; cotton- and wood-flour filled—650° F.; asbestos- and mica-filled—900° F. In some cases die conditions and other factors make it necessary to deviate slightly from the set temperatures.

The means of pressure consists of special machines, hand and automatic. For small quantities, a machine similar to an arbor press is used. The length of time that the pressure is applied on the molded part depends on the type of material being branded. This will vary considerably, depending on the fillers and resins used.

Where the marking is desired on the periphery of a cylindrical molded part, rotary machines are used. In these operations, the article to be branded is revolved against the face of the branding die.

Colors Permanently Fused

Contrasting, plain, and metallic colors permanently fused into the depressed markings are obtained from pigmented foils. These foils are approximately 200 feet long and are available in any desired width. The chemical formulae of the adhesives used on these foils must vary, depending on the type of filler and resin used in the molding material.

Owing to the inability of the foils to withstand the high branding temperature required for phenolic materials, it is necessary to produce the colors by means of a double pressing operation. The first pressing operation produces the required depth. This is followed by a *quick* second repeated cycle which presses the pigmented foil into the marking. In the event that the molded part is to be subjected to a continual contact with moisture which might injure the pigmented foil, the branded depressions should be filled with lacquer or varnish.

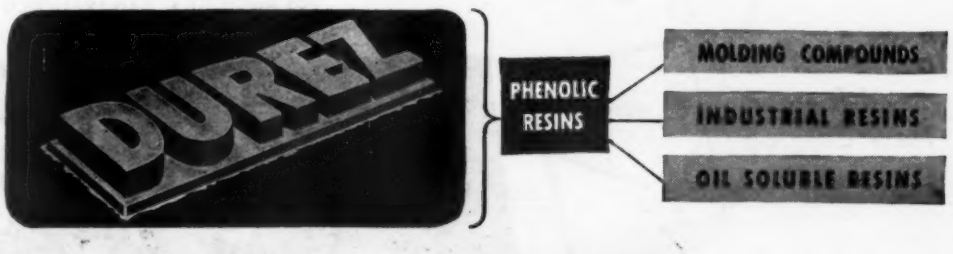
Economies of Branding

The marking of molded plastic parts by the branding process is quite prevalent in the plastics industry because of the economical simplicity with which blank stock parts can be produced in an inexpensive mold and then branded with any desired lettering.

Expert Assistance Available

The benefits of the vast experience which Durez technicians have acquired during the past quarter century are available at all times towards furthering your progress in the machining and finishing of phenolic plastics. Durez Plastics & Chemicals, Inc., 539 Walck Road, North Tonawanda, N. Y.

The two molded phenolic parts shown have branded markings. Courtesy Rogan Brothers.



PLASTICS THAT FIT THE JOB

COLMONOY No. 5

Hard-facing protection against BOTH corrosion and abrasion

● COLMONOY No. 5—Rockwell C 45 to 50—is a valuable member of the Colmonoy group of hard-facing alloys. In spite of its hardness it possesses sufficient ductility to prevent cracking when applied. It can be machined with tungsten carbide tools and finished by grinding.

This ductility of COLMONOY No. 5 is of prime importance when hard-facing many types of work where cracks are apt to develop because of irregular shapes and dimensions, particularly when hard overlays are required.

COLMONOY No. 5 has excellent resistance to corrosion, and is only slightly less resistant to abrasion than COLMONOY No. 6, which qualities make it an excellent hard-facing alloy for use on pump sleeves, plungers, wear rings and other parts subject to combined corrosion and abrasion.

SPECIFICATIONS

COLMONOY No. 5 is a nickel base hard-facing alloy. Rockwell C hardness, 45 to 50. Specific gravity, 6.84. Melting point, 1950° F. Approximate composition: Ni. 74-84; Cr. 8-13; B. 1.5-2.5; Fe. Si. and C. 9 max.

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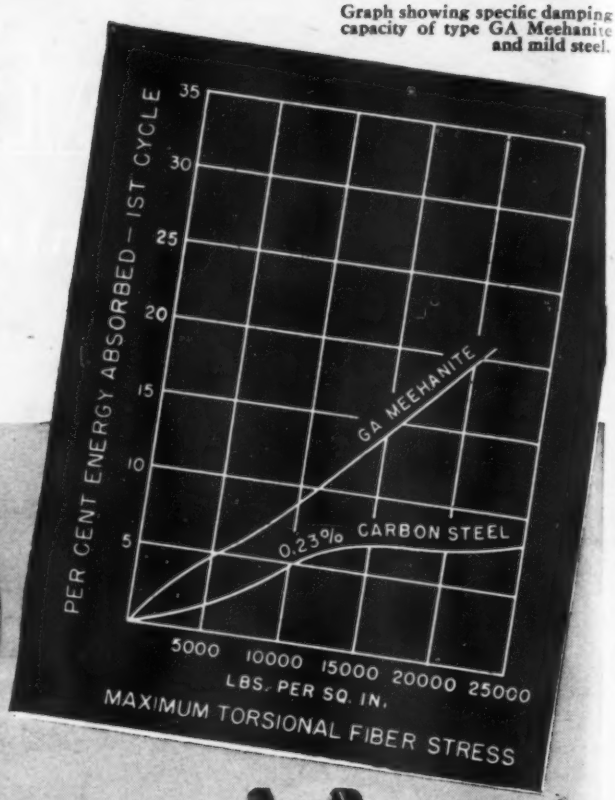
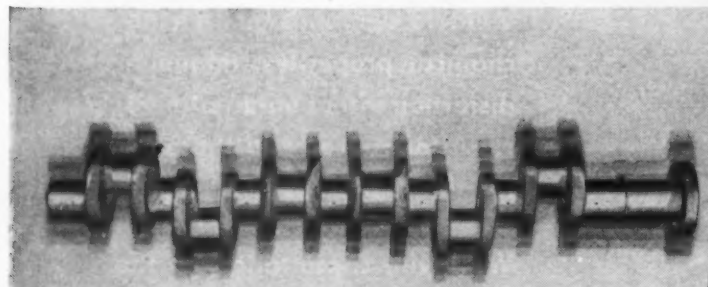
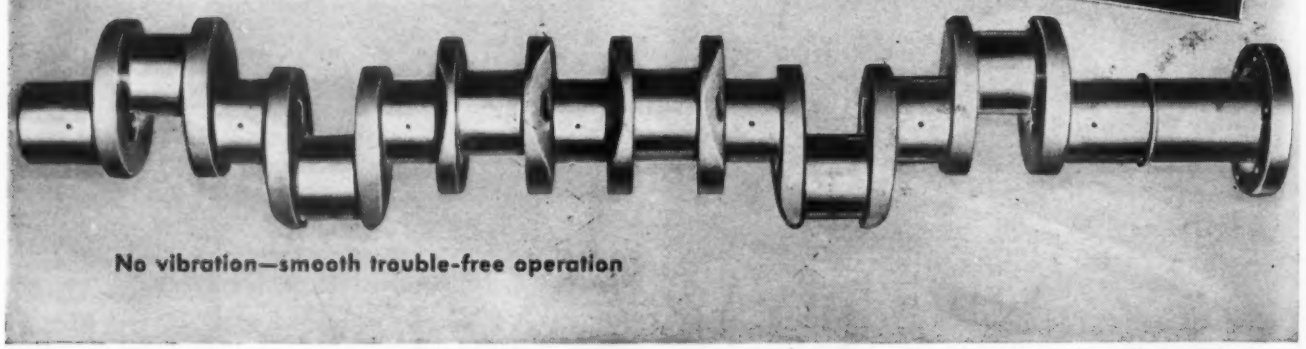
MEEHANITE'S VIBRATION ABSORPTION

Graph showing specific damping capacity of type GA Meehanite and mild steel.





Vibration means ultimate destruction



No vibration—smooth trouble-free operation

FACTS, FIGURES, DATA,
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OF MEEHANITE CASTINGS

Damping critical vibration in crankshafts, propellers, machine tool parts, housings of heavy machinery and other components repeatedly subjected to high stresses, involves both the correct selection of materials and in some cases the use of mechanical damping devices.

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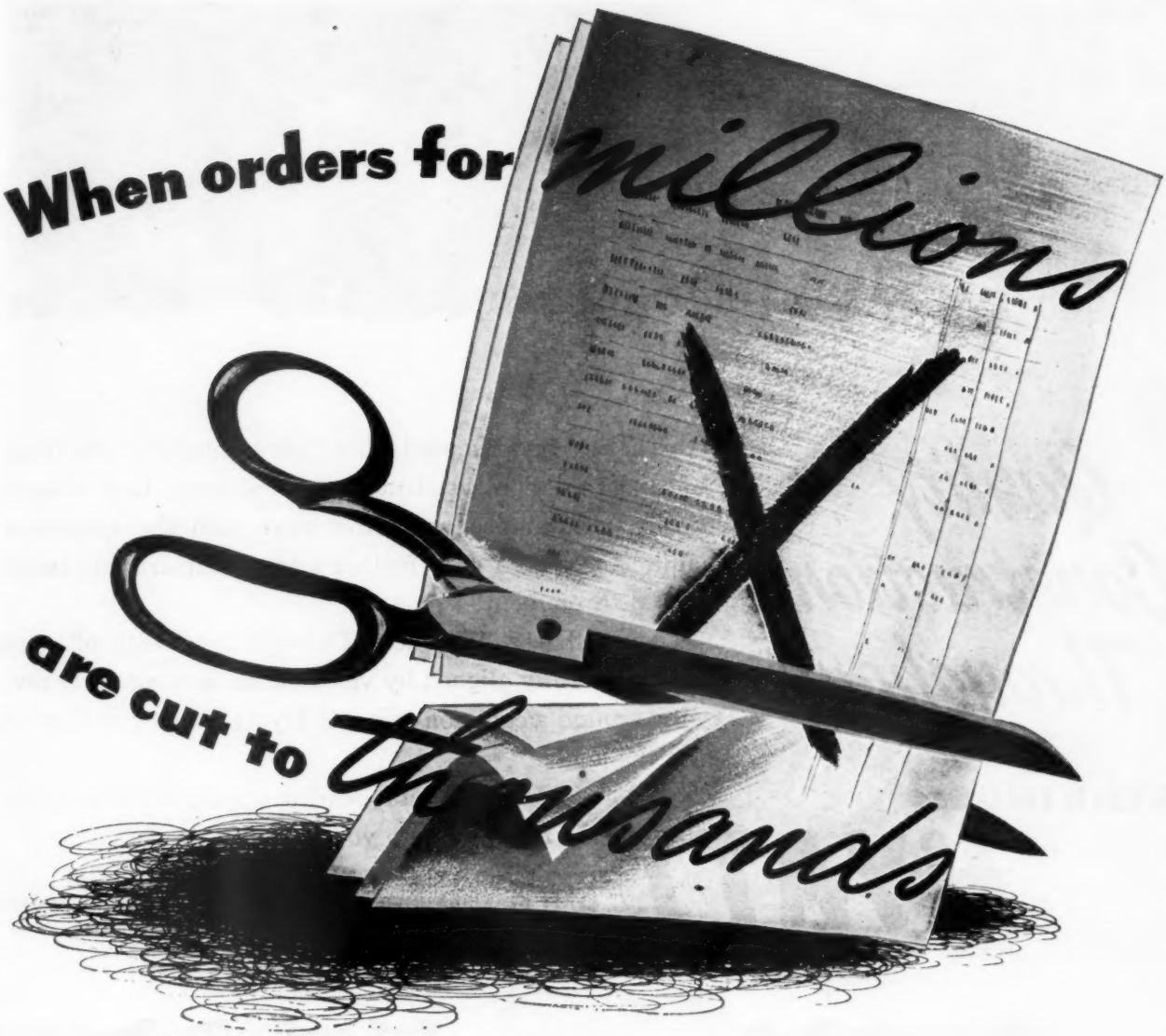
Thus Meehanite Castings are being widely used in the construction of precision machinery where resonant vibrations might cause inaccuracy in performance. They also find many applications in stressed units where weight, noise and the absence of notch sensitivity are important factors in service life and operation.

For the complete story of the manufacture, metallurgy and engineering properties of Meehanite Castings write for the Meehanite Handbook.

MEEHANITE RESEARCH INSTITUTE
NEW ROCHELLE, N. Y.



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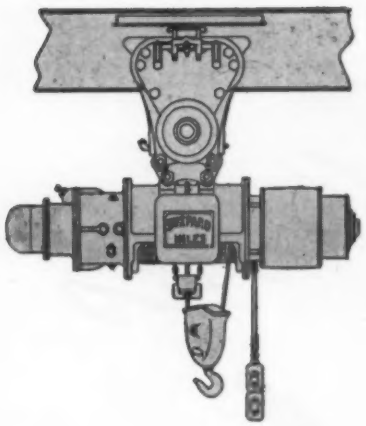

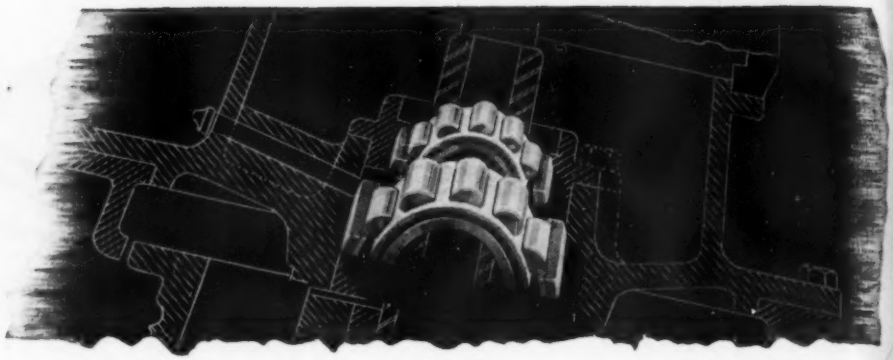

Quality Construction Throughout...

"In this hoist," says Shepard Niles, "are embodied all the features of modern design, construction and stamina that assure dependable performance year after year with the minimum of maintenance." And they further add—"Anti-friction bearings are used throughout."

They call it a "Balanced Drive" Unit—with all gearing permanently aligned by virtue of all moving parts revolving around a common axis and Hyatt Roller Bearings carry the load.

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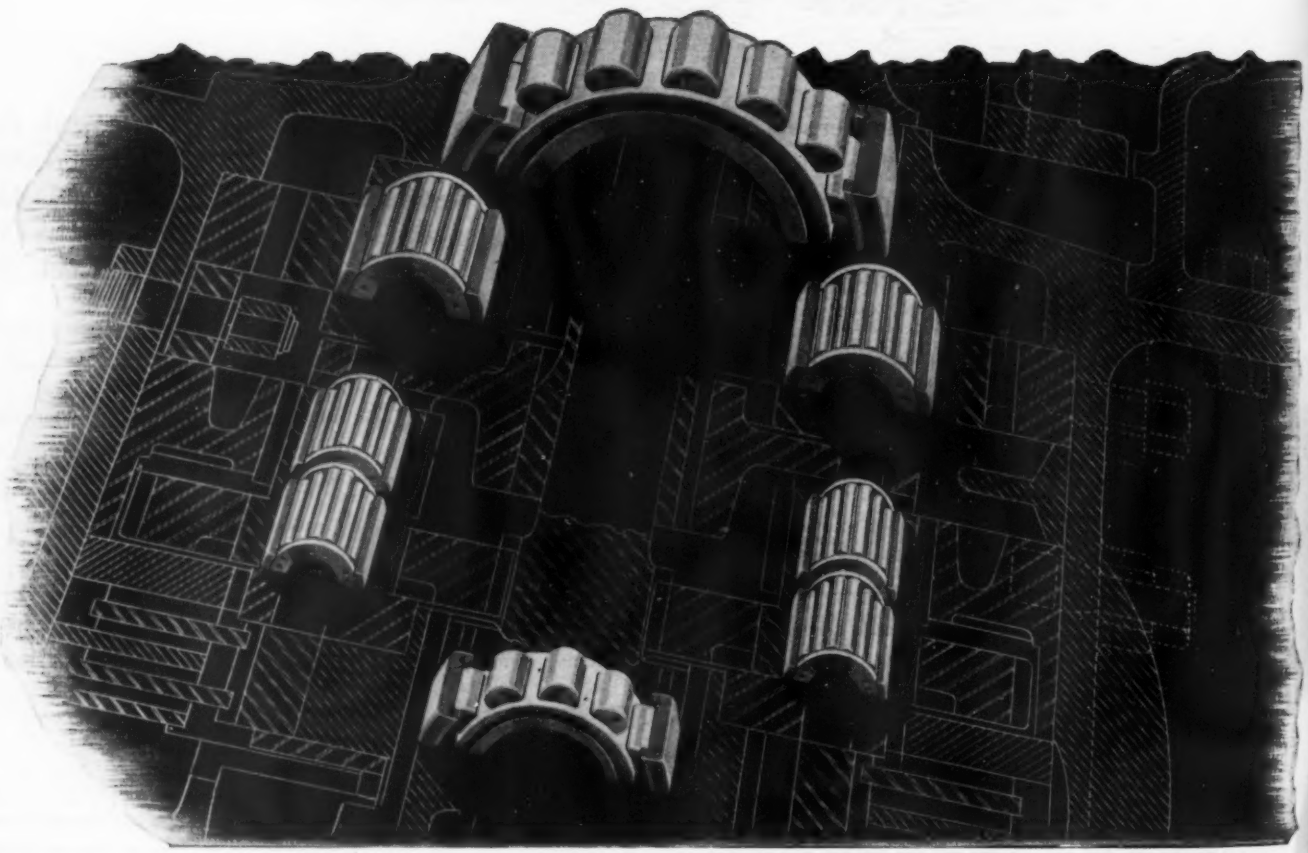
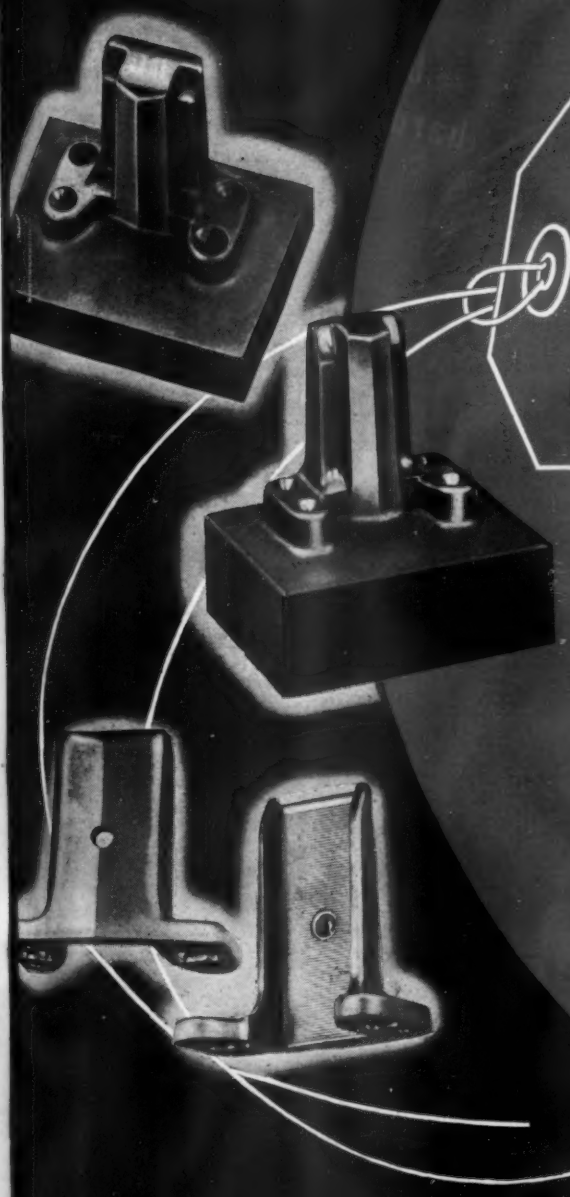


When it's a question of HUBS



PAR-EXC
SPEAKS FOR ITSELF

For instance, these PAR-EXC Hubs shown above (dimensions at base, 3"x4"; overall height, 5½"). Pressed into refined iron in two sinkings, the hubs produced desired cavities for use in a die casting machine which makes the piece parts shown at lower left. Simple heat treatment consisted of packing in 50% new compound, heating to 1700°F. and holding for 12 hours, followed by an oil quench. The hubs were then drawn at 700°F. to a hardness of Rockwell C 59-60.

Fine tough steel for hubs, PAR-EXC . . . use it on *your* next job!

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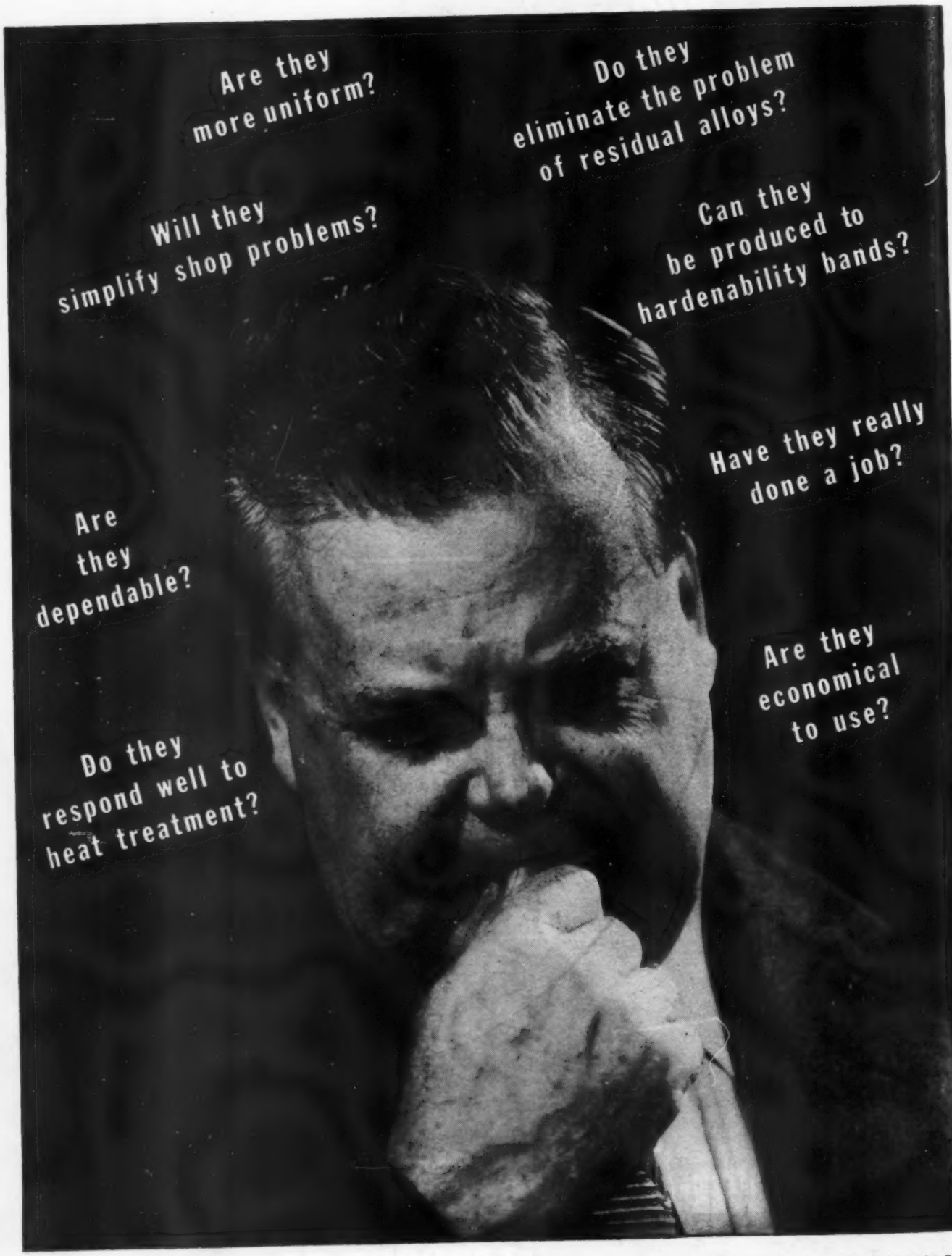
Colonial Steel Division · Anchor Drawn Steel Co.

If you're asking


Are they more uniform?
Do they eliminate the problem of residual alloys?
Will they simplify shop problems?
Can they be produced to hardenability bands?
Have they really done a job?
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these questions about

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. . . *the answer is YES!*

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Triple-Alloy Steels owe their success to one general, outstanding characteristic—UNIFORMITY. Uniformity in response to annealing. Uniformity in fabrication. Uniformity of hardenability. Uniformity in heat treatment.

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These are not theoretical metallurgical assumptions, but facts. Facts established by the successful use of more than 15 million tons of Triple-Alloy Steels in such critical applications as aircraft engine parts, propellers, tank, truck and combat vehicle parts, gun tubes and parts, and in gears, bearings and heavy-duty shafting of all kinds.

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****The Triple-Alloy Steels most commonly used are the* 4300-8600-8700-9300-9700-9800 *and* 9900 *series. Our metallurgical representatives are thoroughly experienced in their application in aircraft, automotive, oil well drilling, tractor, railroad and general heavy-industry parts, and will gladly assist you in selecting the particular steel best suited for your requirements.***

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UNITED STATES STEEL

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REVERE Welded Steel Tube can be had either in straight lengths, or partly or completely pre-fabricated. Our tube-working equipment is highly specialized, and customers frequently find that it effects appreciable savings in costs.

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AGAIN, REVERE IS READY NOW!

Revere metals are impartial. They don't care whether they are used for battleships or baby carriages, for rockets or refrigerators. That is why there is practically no reconversion problem at Revere to slow down production of copper, brass, bronze, aluminum, magnesium, steel.

We are ready *now* to fill industry's peacetime needs.

Revere hopes that, in the conflict just ended, what we won was the gigantic opening battle for better living. To fight *this* war our nation needs materials and the products of industry on a scale even greater than that which won military victory.

One inevitable result of Revere's war effort is that not only our ability to produce, but our ability to give service, have been expanded many times. Revere research has probed further and further. Revere Technical Advisors are armed with greater knowledge and experience. New methods and new machines may save precious time or cut all-important cost.

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Tool engineers will find this new HAYNES STELLITE tool catalog a practical help in planning and operating all kinds of production machining jobs. The sample pages above show how it provides a simply arranged and complete list of the available HAYNES STELLITE tools with their specifications and prices.

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HAYNES TRADE-MARK *alloys*

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Flexible METAL HOSE AND TUBING

Machine Designers continue to create remarkable equipment for high speed automatic production. Modern machinery is almost human. There's one difference, however. MACHINES MUST BE FED THROUGH TUBES.

American Flexible Metal Hose and Tubing have increasingly taken over this task, in the form of Engineered Assemblies for carrying the important lubricants, coolants, compressed air, hot water, steam, other liquids and semi-solids, without which most machines cannot function.

For such duties METAL is the dependable material . . . Flexibility, the required characteristic. Both are inherent characteristics of "AMERICAN" Products.

YOU can fit "American" assemblies into your blueprints, as hundreds of machine (and product) designers are now doing. You can obtain, through "American's" engineering service, the exact size and type of tubing, the correct pressure resistance, the fittings or couplings . . . to meet your specific requirements . . . all assembled as a dependable unit, ready to install as an integral part of your machine or product. (Note examples on the following page.)

AMERICAN FLEXIBLE METAL ASSEMBLIES also absorb vibration in feed or exhaust lines; compensate for misalignment of tappings; connect moving parts; and, used as conduit, protect delicate wiring in instruments or electrical appliances.

The "life lines" of your product or machine must be *Right*. Get them "Right" from the start . . . on your blueprints. Specify American Flexible Metal Assemblies.

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AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

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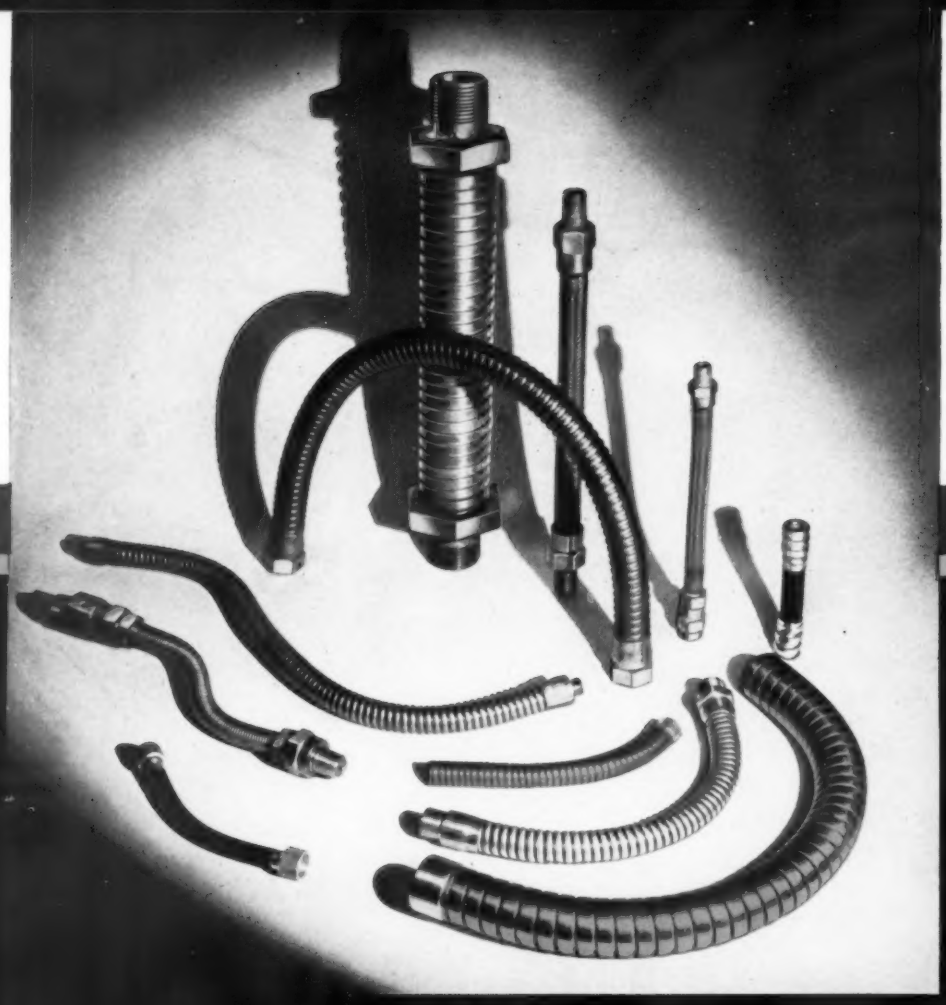


ENGINEERED TO YOUR REQUIREMENTS

Above are shown a few of the thousands of "American" Assemblies engineered for specific duties.

These assemblies cover a wide field of applications. They carry delicate perfumes to filters. They serve as hydraulic oil lines in steel mills or as refrigerant lines on railroad cars . . . a multiplicity of duties where failure of hose or tubing cannot be tolerated.

They are made from seamless tubing — no seams, no welds, no joints, no packing . . . as leakproof as the rigid tubing from which American Seamless is made. "Seamless" can be supplied with one or more protective braided wire jackets to withstand extremely high pressure and continuous flexing.

AMERICAN "Interlocked," "Square Locked" and "Ball Bearing" are styles made from strip metal, carefully profiled and wound with each convolution, packed and securely locked with the next. They carry oil, steam, water, hot air, dust, chips or act as moisture-proof conduit.

A wealth of information for Design and Production men will be found in the bulletins shown below. Write for your copies today.

45257

FOR DESIGN AND PRODUCTION MEN

ANACONDA

AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Conn. . . . Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Making Surgical Instruments of Stainless Steel

A report on one manufacturer's methods of forging, heat-treating and finishing small STAINLESS STEEL parts

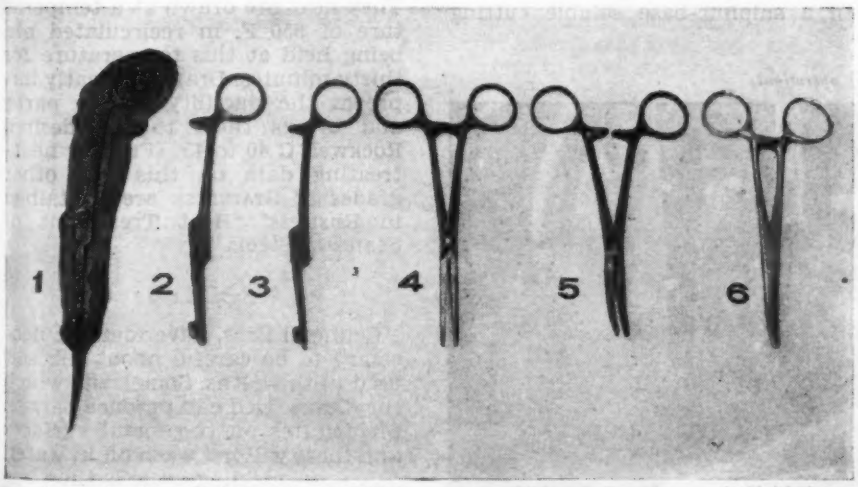
STAINLESS STEEL which is to be made into surgical instruments of carefully controlled qualities needs extra care in heat treating. Inspections likewise must follow more of the production operations than is usual with ordinary "carbon" steels. With these precautions and a few changes in procedures STAINLESS STEELS can go down the same production line as ordinary steels. Elimination of plating is a great advantage to both the fabricator and the user. Such is the experience of Schnefel Bros. Corporation, Newark, N. J., makers of the famous "La-Cross" instruments.

The STAINLESS STEEL itself, of course, must be made with utmost care, the way it is made by Rustless Iron and Steel Corporation. Any lack of uniformity in the steel can cause trouble along the fabricator's production line by yielding irregular response to standardized heat-treating and finishing procedures. In fact, the proper grade for surgical or dental instruments and similar devices is one which must consistently produce a hardness of Rockwell C 40 to 45 following a prescribed heat treatment. Important also is sales engineering service such as is given by Rustless. This service is periodic, beginning with the first lots of STAINLESS STEEL to be fabricated and continuing whenever minor troubles occur or changes in procedures are made to improve results and reduce costs.

The first production operation in making artery forceps, for example, is slitting. Most surgical instruments are pointed; therefore, when flat bar stock raw material is used it is slit diagonally instead of being cut off square thus providing two pointed ends simultaneously. When round stock is used it is generally forged off the end of the bar.

The hot forging operation follows. Forging is done on small (500 to 800 lbs.) board drop hammers. The operator is able to raise the hammer to various heights and therefore to strike blows of varying forces. He can vary the number of hammer blows applied to each piece, being careful not to fold or wrinkle the metal. Generally he finishes each piece with three or four full blows; any greater number may permit the steel to cool too much and result in hardening. This particular grade of STAINLESS is drastically air hardening when cooled quickly from above 1500°F.

Trouble at the hammers is readily avoided if the correct heating method is used. STAINLESS STEELS must be heated to slightly higher forging temperatures than carbon steels and must be struck harder blows. The operator who is used to judging carbon steel temperatures "with his eye" may go wrong on STAINLESS temperatures. Schnefel finds it entirely satisfactory to use an optical pyrometer to check this several times every day while some other shops prefer a recording pyrometer. The material is heated to between 2100°F. and 2200°F.



1. The forging. 2. Trimmed. 3. Milled. 4. Assembled. 5. Jaws bent. 6. Finished.

Controlled Soaking

A heating and soaking period of about five minutes is necessary, depending upon the stock size. And this also must be controlled. Too short a soak means poor forging, too long means excess scale which will be beaten into the surface of the metal by the hammer and cause indentations which increase the costs of polishing.

An average forging time cycle for each kind of instrument part is used to control the heating and soaking time. On one part, for example, it takes ten seconds for the operator to put a cold piece into the furnace, take a heated one out, do his forging, plunge the forged piece into a refractory material and pick up another cold piece. Since a five-minute period contains 300 seconds, the keeping of 30 pieces in the furnace at all times and taking them out and replacing them in rotation will result in a five-minute heating and soaking period for each.

Slow Cooling

The pieces as lifted from the dies are at about 1600°F. They are buried immediately in the refractory material so they will cool slowly as otherwise they might strain crack. As a rule they are left to cool below 300°F.

After being removed from the refractory material, the pieces are

(ADVERTISEMENT)

The furnace with the drop hammer at work.

pickled in full strength commercial muriatic acid, or the solutions recommended on Pages 40 and 41 in Rustless' booklet "Heat Treatment of Stainless Steels," to remove the forging scale.

Annealing at Schnefel Bros. is in sealed 35 nickel, 15 chrome pots placed in a Hones atmospheric-type furnace. Four hours' time is used to bring the cold pots up to 1600°F. to 1650°F. The pots are held at that temperature for at least one hour. Cooling is by easy stages. With heat kept on the furnaces the pots are allowed to cool not more than 200° in the first hour and 200° more in the second hour, and cooling will be slower than this if the parts had been harder than Rockwell 25C. But when the pots are down to 1200°F., the heat is turned off and the pots are allowed to cool in the furnace for the remainder of the annealing period.

Rockwell Test

The parts are pickled again to remove the light scale and then hardness tested. A hardness of Rockwell B90 Max. is aimed at as this is excellent for machining. To remove any remaining forging and annealing scale the parts are tumbled overnight. Tumbling imparts a rough polish. The parts are inspected again for any pits or faulty surfaces or other defects which might make further operations inadvisable. Nearly all pass inspection and are sent to the secondary operations departments.

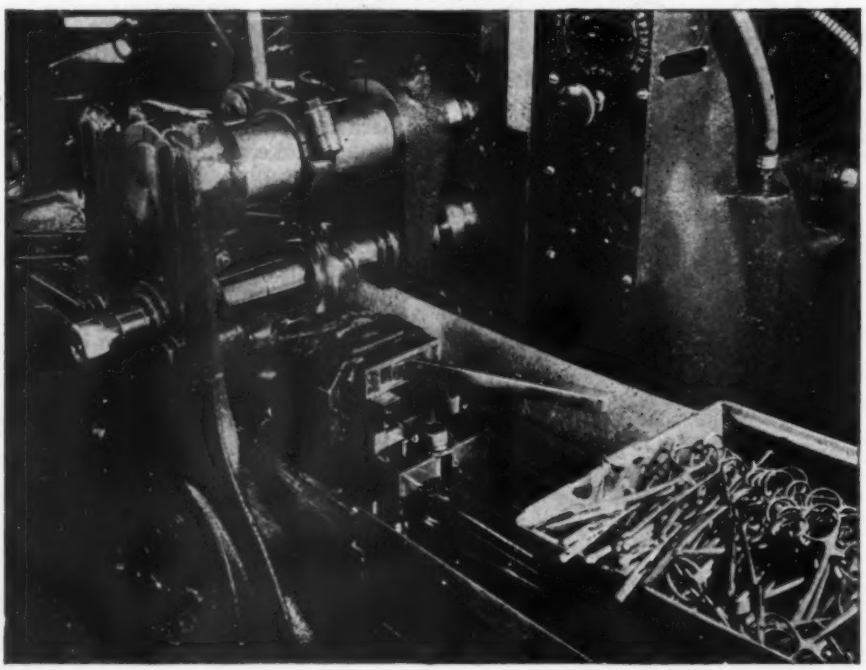
Secondary operations include trimming in punch presses, cold pressing, drilling, rough grinding, shaping the blades, and some spot welding in the case of tweezers. There are no important deviations from the processes applied to carbon steels except that the forging flash may be removed from carbon steel parts by cold punching before annealing but in the case of STAINLESS STEEL the flash is removed after annealing. Milling of the STAINLESS STEEL is about 15% slower than that of carbon steel and the milling cutters have from 30% to 40% shorter lives. The operation gave trouble until a sulphur-base soluble cutting oil recommended by Rustless Iron and Steel Corporation engineers was used.

Trimming off the flash.

Final Heat Treatment

After the secondary operations Schnefel gives the parts their final heat treatments. They are heated to 1825°F. in free rinsing salt, held for a 5-minute soaking period and quenched in low viscosity quenching oil. Rockwell testing follows the rinsing of the quenching oil in alkali cleanser and hot water. The parts now must show a uniform Rockwell hardness of C 47 to 50. They next are drawn at a temperature of 550°F. in recirculated air, being held at this temperature for thirty minutes. Drawing greatly improves the ductility of the parts, and brings them to the desired Rockwell C 40 to 45. (Further heat-treating data on this and other grades of STAINLESS are contained in Rustless' "Heat Treatment of Stainless Steels.")

One of the milling operations.



Salt Bath

Schnefel Bros. have found it necessary to be careful about the salt used in the baths. Some salts which they have tried can produce barium precipitates on the metal surfaces and these will not wash off in water.

A short pickling cycle is then applied prior to grinding to remove the slight scale resulting from heat treating.

The final operations such as pointing, shaping, buffing, assembling and final polishing are done by skilled craftsmen.

It is here that the rewards of careful control in inspecting and heat treating are found.

An operator buffs a piece largely

by its "feel" against the wheel, but that will tell him very little if he does not know exactly how his material will behave. Shaping and pointing the instruments—a buffing and hand-grinding process — is judged somewhat by visual inspection but mostly by the feel of the precisely tempered STAINLESS STEEL. The all-important "setting up" operation, getting the blades to meet exactly right and with precisely the right amount of friction at the joints, making sure that ratchets which are to hold instruments at exact pressures on arteries of the human body will hold just right but will not stick, is a matter of knowing exactly how the instrument should feel and of being sure that if it feels right it is right.

Nitric Acid Passivating

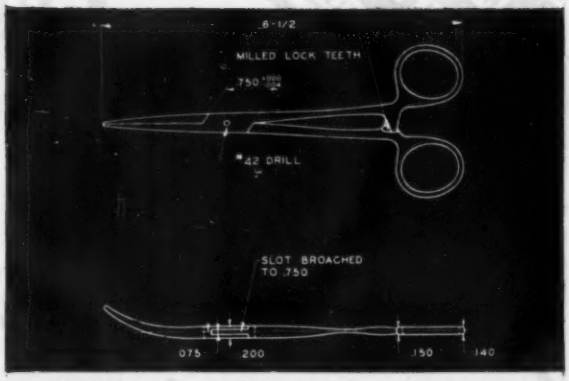
Passivating, to remove the last traces of foreign material and fortify the natural passive surface film in areas inaccessible to the buffing wheel is the last operation before a final light buff. A solution of 18—22% nitric acid at 110°—120°F. is used.

There are tests which the instruments for the Government must pass. One of them is the "blue stone," another the "boil." In the blue stone test the parts are submerged for 6 minutes at room temperature in a standard solution of copper sulphate, sulphuric acid and water. The parts must show no plating-on of copper. (Government Specification 57-1-3.)

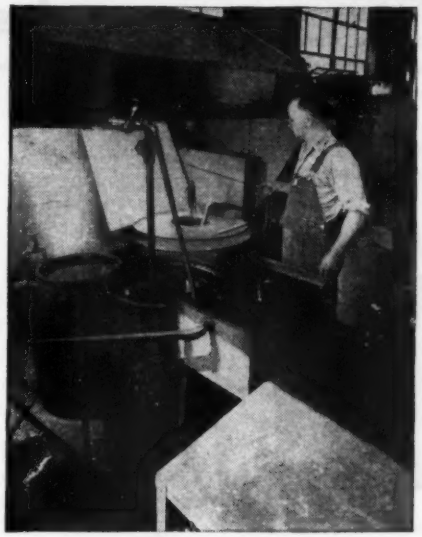
Boil Test

In the boil test the parts are cleaned with soap and water, dipped in alcohol, dried in an oven or wiped dry, submerged in still water, brought to a boil, boiled for thirty minutes and then allowed to remain submerged for 24 hours. Not more than 2% of their surfaces (visual estimation) may then show any discoloration.

These tests are standard. But for the real test, no standard can be laid down. The real test is the way the instruments feel in the hands of a surgeon or a nurse while working against split seconds of time to save a human life in a hospital or on a battlefield. It is a real tribute to American manufacturers that a tremendous number of satisfactory instruments were made during the war when many, unlike Schnefel Bros., had had little or no previous experience in the field.



That exactly right, completely dependable "feel" is put into their splendid instruments by the careful heat treatments, inspections, and workmanship of Schnefel Bros. But behind it is the equally careful work of Rustless Iron and Steel Corporation. It is a strange fact, but success in the operating room starts in the steel mill.



Salt bath hardening. Note nearness of quench tanks.

Rustless specializes in STAINLESS STEELS, and through long, concentrated study and experience has learned how best to forge, heat treat, machine, electropolish, and otherwise fabricate STAINLESS into products of enduring beauty, cleanliness and economy. All our knowledge is at your command. Our engineers will gladly work with your production men. The authoritative Rustless booklets are free. The one mentioned in this advertisement, "Heat Treatment of Stainless Steels", containing 56 pages and 9 Data sheets will be sent on application.

Finishing on the wheel.

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Rustless

Producing STAINLESS STEELS *Exclusively*

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HALLOWELL

SHOP EQUIPMENT OF STEEL

for Convenience, Economy and Long Wear

Thousands of users all over the country know that "Hallowell" Shop Equipment signifies sturdy construction, good design, years and years of wear, and economical prices.

"HALLOWELL" Work-Benches of Steel are an asset in any shop. Exceptionally strong and sturdy, they are built to stand firm and rigid *without* costly bolting to the floor. Over 1300 ready-made, interchangeable combinations make it possible for you to find exactly the bench you want without going to the expense and trouble of designing and constructing one of your own.

Fig. 732. Pat'd. & Pats. Pend. Drawers are extra.

Fig. 1731

Fig. 1731—"HALLOWELL" Bench with backboard, two four-drawer tiers and lower shelf for blueprints, etc.

Fig. 1249

"HALLOWELL" WELDED STEEL STOOLS are sturdy, wobble-proof and adjustable. Available in numerous styles, with or without backrest.

"HALLOWELL STEEL TRUCKS roll easily under all loads—their welded construction defies time and abuse.

"HALLOWELL" DeLuxe Shop Furniture

. . . has been designed specifically to fill the complex needs of modern shops. In line with this, the DeLuxe Line—which includes Work-Benches, Tool Stands and Foremen's Desks—is standardized. Shelf, cabinet and drawer units are interchangeable, providing a variety of styles and models to fill individual requirements.

Write for the Catalog of "HALLOWELL" Shop Equipment of Steel

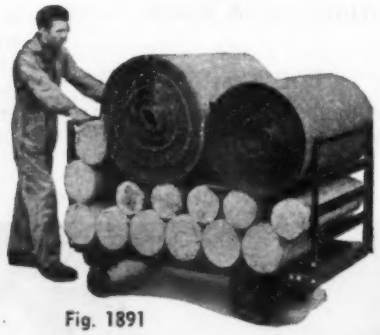

Fig. 1891

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 4

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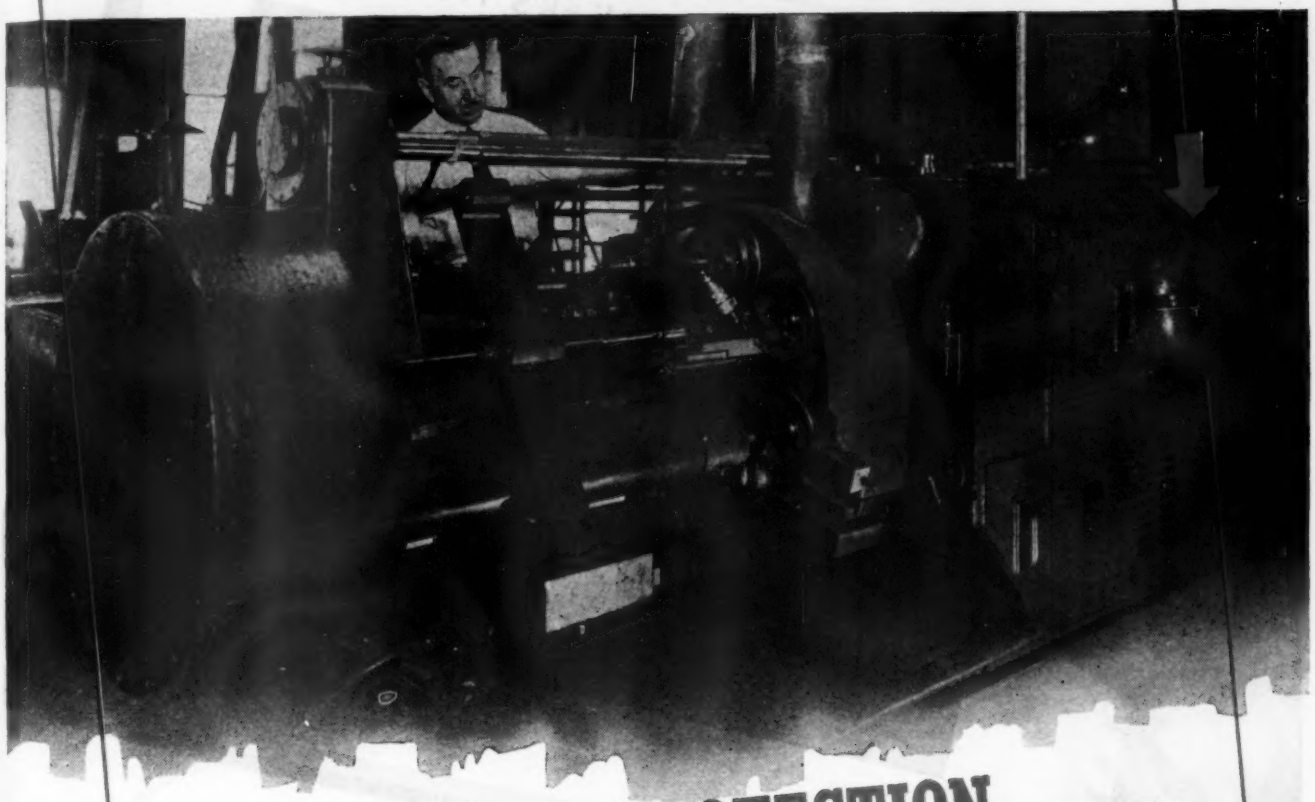
15 horsepower Century Totally Enclosed Fan Cooled Motor driving a multiple spindle automatic lathe. This motor is protected against dust, chips, and coolant mist.



FOR MAXIMUM PROTECTION AGAINST DESTRUCTIVE ATMOSPHERES . . . *Use* CENTURY TOTALLY ENCLOSED FAN COOLED MOTORS

The thorough protection of the vital parts of Century Totally Enclosed Fan Cooled Motors guards against such destructive forces as abnormal amounts of metallic and abrasive dusts, metal cuttings, coolant fog or mist, oil-laden factory dust, chips, etc.

The inner sealed frame of these motors prevents destructive, dust-laden atmosphere from getting into the motor.

Another feature that contributes to longer motor life is the effective cooling of Century TEFC Motors. A large, enclosed fan forces a controlled blast of cooling air through the large air passages, over the active magnetic material and around the bearing housings.

For protection that will keep your machines operating in destructive atmospheres, specify Century Totally Enclosed Fan Cooled Motors. TEFC Motors are only one of the wide range of sizes and types of Century Motors from 1/8 to 600 horsepower.

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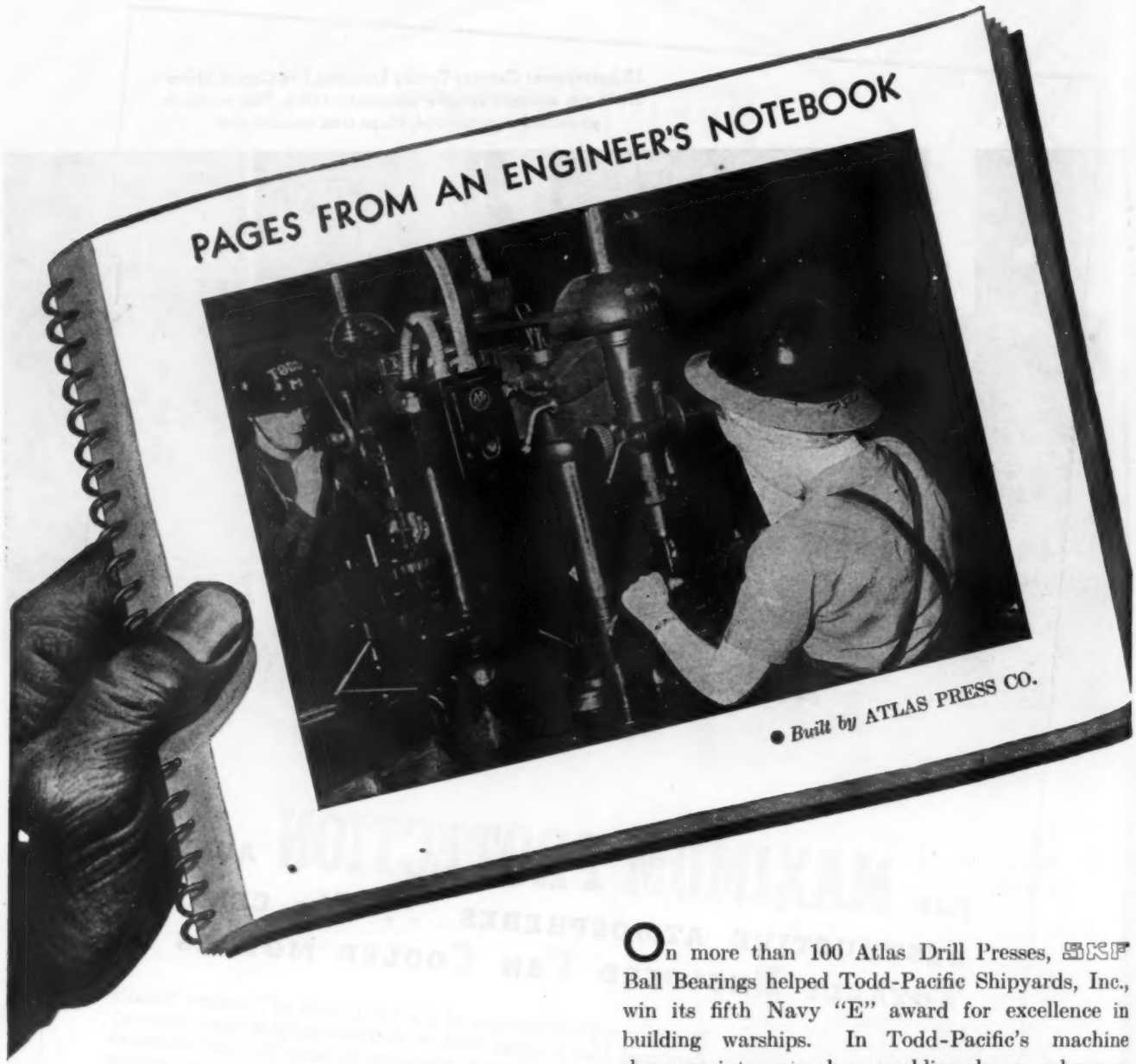

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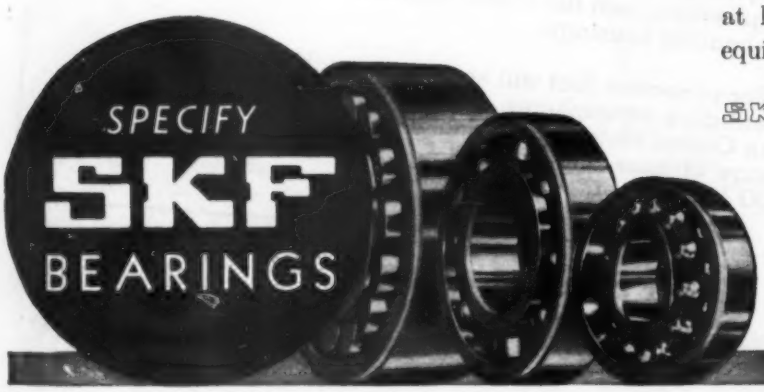

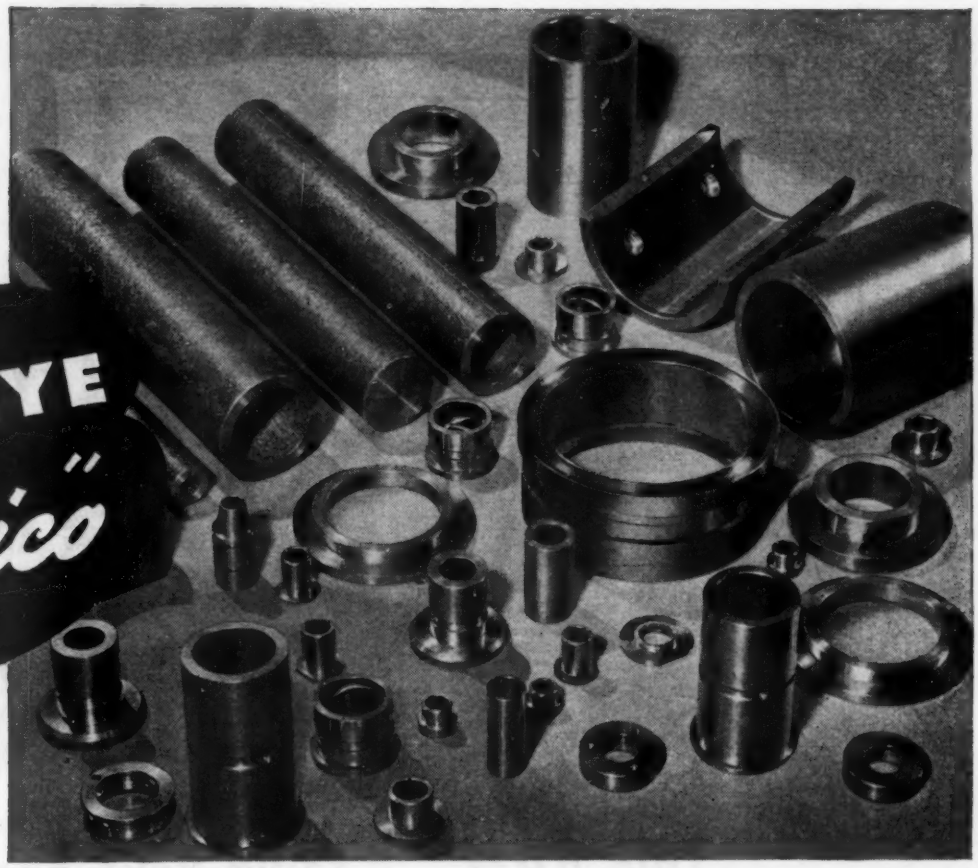

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Manufactured from selected metals under Buckeye's exacting laboratory and metallurgical control, these bearings have uniform dispersement of lead throughout. They are free from porosity, and accurately dimensioned assuring speedy, easy assembly. Furnished in any of our 1088 stock sizes, or to customers ID, OD and length; slotted, drilled, flanged or threaded exactly to blue-print. Furnished in three different metal analyses, for light, general, and extremely heavy duty services. Let us quote on your requirements.

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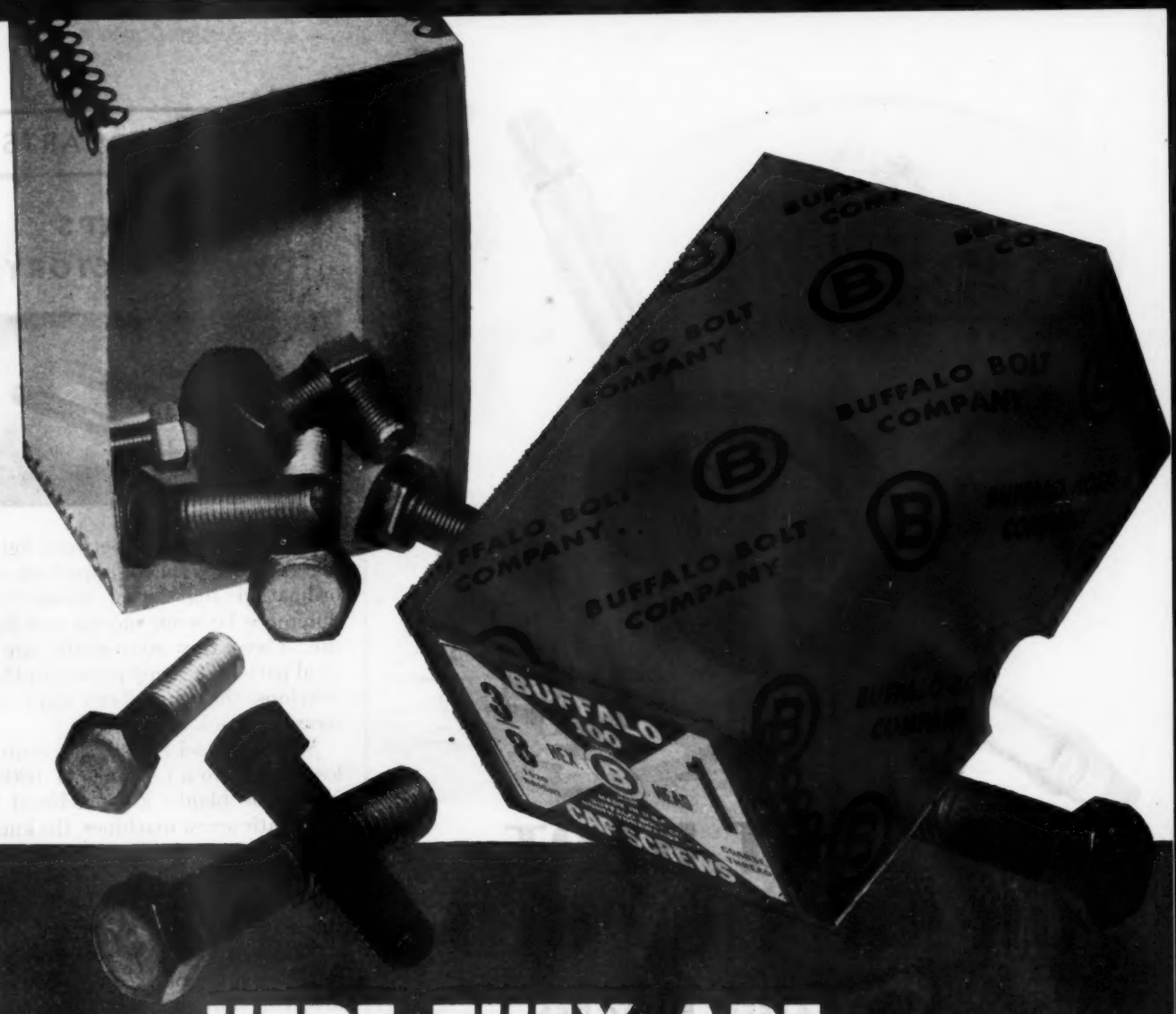

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At the request of many manufacturers and members of the trade, we have augmented our line of circle Ⓑ fasteners with a complete assortment of cap screws in all stock sizes, both bright and black satin finish. These new products, of Buffalo Bolt quality and uniformity from head to the final thread, are now available through your jobbers. Write for complete specifications and list of stock sizes and name of jobber in your territory.

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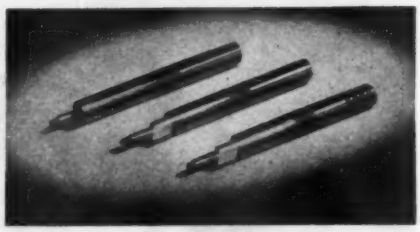

Fast communication between fighting-units gives the all-important coordination that often means the difference between success and failure. These tiny rotor-shafts are a vital part of an Army generator that develops the "juice" to send the messages back and forth.

Stainless steel bar-stock is centerless-ground to a tolerance of .0005". Next, the blanks are machined in automatic screw machines, the knurl being held to .002" on the outside diameter. The flats are straddle-milled and the shaft is completed by thread-grinding the worm.

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Now, while you are designing or redesigning products for the postwar market, is the time to question every fastening. Is there any needless tapping? Avoidable bolt assembly? Costly inserts in plastics? Riveting in hard to reach places?

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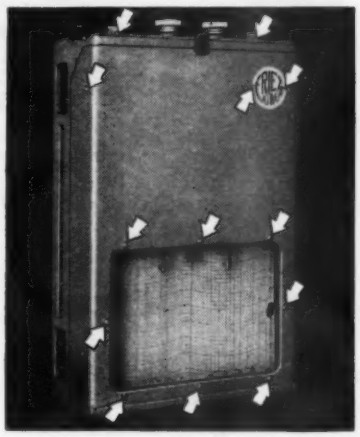

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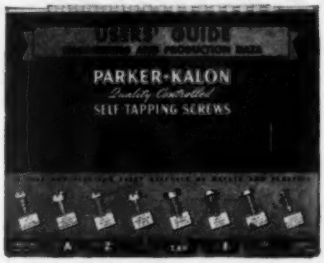

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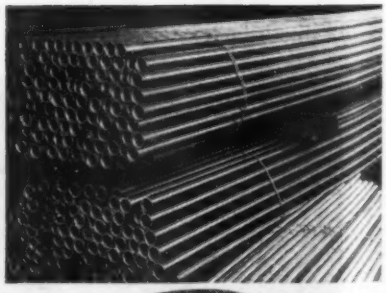

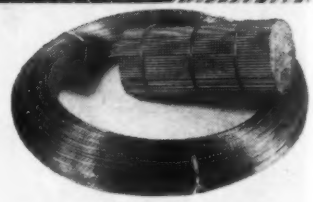

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The CENTRIFUGAL PUMPS of *Superformance!*

- More volume per horse power
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- Compact... Streamlined design

Models for Most Every Need

For horizontal-external mounting.

For submerging in coolant reservoir.

For submerging in tank and mounting to cover.

For submerging in tank, or mounting integrally with cover.

•The advanced design and built-in efficiency of Superflo Pumps gives them increased capacity to the point where, a 1/8 H.P. model is equal in volume delivered to many 1/4 H.P. pumps.

Superflo's integral-streamline design gives compactness, strength and ease of installation. Dependable—service-free in performance, they are ideal for pumping coolants, cutting oils and lubricants, and are easily adapted to any machine. The flow can be regulated from a drip to a full stream without overloading the motor. Capacities from 9 to 44 gallons per minute. Models available for fluids with high abrasive content. There's a Superflo Pump for "superformance" on almost every application . . . for replacement or as original equipment. Write and tell us your needs.

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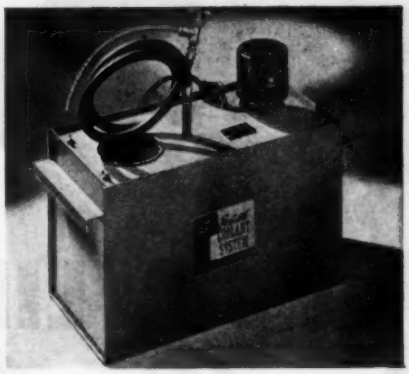
INDUSTRIAL FLUID REFRIGERATION • PARTS CLEANING SYSTEMS

GRAY-MILLS *Portable* PUMPING UNITS



Gray-Mills Centrifugal Model. Available in two models—540 gallons per hour and 2650 gallons per hour at 4 foot heads.

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In hundreds of industrial applications Gray-Mills Pumping Units are supplying fluids, such as those listed above, for a variety of uses. These compact, self-contained systems apply a fluid at the point of use, either in constant flow or intermittently. They may be used for recirculating fluids, as in a coolant system—or to pump liquid from one point to another.

Think over your fluid handling problems—perhaps you'll find a Gray-Mills unit is a simple, low-cost answer—and if you have a special problem, there is a Gray-Mills engineer ready to help you work it out. Write for catalog and full details.

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GRAY-MILLS CO.

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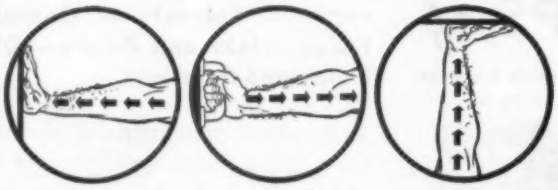
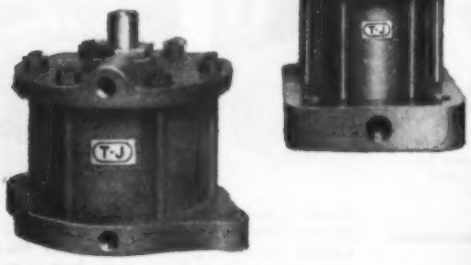
for TOUGH JOBS!

T-J CYLINDERS *Simplify* — POWER MOVEMENT



FOR PUSH-PULL-LIFT JOBS... 100 LBS. OR 50,000 LBS.

Apply a T-J Cylinder to eliminate muscular effort or to simplify mechanical movements—the ideal way to clamp, press, raise or shift in any direction. T-J Engineered and built in many styles, sizes and strokes to meet your requirements... exerting power movement of 100 lbs. to 12,000 lbs. (direct) with T-J Air Cylinders... 1,000 lbs. to 50,000 lbs. (direct) with T-J Hydraulic Cylinders. Easily and quickly installed. Write for latest catalog.



T-J RIVITOR *Sets 'em fast*

Here's speedy, efficient, automatic-feed riveting to help you increase production and cut costs—the machine for the job is the T-J RIVITOR! Electrically powered for automatically feeding and setting solid steel rivets 1/16" to 1/4" dia. incl., and up to 7/8" incl. long. Work requiring up to 36" throat depths can be accommodated. Ruggedly built... designed with T-J know-how based on 28 years experience ...Write for bulletin. The Tomkins-Johnson Co., 601 Mechanic St., Jackson, Mich.

FOR AUTOMOBILES... STOVES... FARM MACHINERY... KITCHEN UTENSILS... TOYS... LAWN MOWERS... STAMPINGS... REFRIGERATORS... WASHING MACHINES... HARDWARE ITEMS... AND MANY OTHER USES...

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

T-J

28 YEARS EXPERIENCE

for MAXIMUM CAPACITY IN MINIMUM SPACE

Interchangeable

WITH SINGLE-ROW BALL BEARINGS

NORMA-HOFFMANN

PRECISION ROLLER BEARINGS

NORMA-HOFFMANN BEARINGS CORP'N.,

STAMFORD, CONN., U. S. A. • *Founded in 1911.*

Write for the Catalog. Let our engineers work with you.

Their solid cylindrical rollers provide maximum contact area, giving larger load and shock-absorbing capacity than any other single-row bearing of like dimensions. Thus, when NORMA-HOFFMANN PRECISION ROLLER BEARINGS are used in place of ball bearings, a greater factor of safety is provided, together with added life, particularly under vibration and overload. PRECISION qualities in workmanship and materials adapt them alike for both low and high speeds.

WHAT'S BEHIND the LINE?

SKILLED MANPOWER Is Behind "Chicago Screw" Products

Trained men and women with intense pride in their skill and in the perfection of the products they make, account in a substantial sense for the dependable quality of all Chicago Standard Screw Products.

Chicago "SAFETY PLUS" Line includes:
Socket Head Cap Screws • Socket Set Screws • Stripper Bolts • Square Head Dog Point Set Screws • Socket Pipe Plugs • Keys for Socket Screw Products.

Complete Line includes:
Hexagon Head Cap Screws • Square Head Cup Point Set Screws • Headless Set Screws • Fillister Head Cap Screws • Flat Head Cap Screws • Taper Pins • Milled Steel Studs • Semi-Finished Hexagon Nuts.

Where increased strength, greater accuracy, a higher degree of uniformity and improved appearance are important, Chicago Standard Screw Products are the first choice of discriminating American industry.

ARMY E NAVY

These Fine Products are sold only thru Authorized Distributors

THE CHICAGO SCREW CO.
ESTABLISHED 1872
1026 So. Homan Avenue Chicago 24, Ill.

AISI **HY-TEN** SAE
NE

ALLOY STEELS FOR VICTORY

Scientifically selected to conserve critical alloys and meet the requirements of the AIRCRAFT, ORDNANCE, and MACHINE TOOL industries.

Complete "EARMARKED" stocks of Aircraft alloy steels at Buffalo and Detroit.

Wheelock, Lovejoy & Co., Inc.
138 Sidney Street
Cambridge 39, Mass.
Cleveland 14, Chicago 23, Newark 5, Detroit 3, Buffalo 10, Cincinnati 32

Judge a coolant pump by the company it keeps

You can best judge a coolant pump by finding out who uses it.

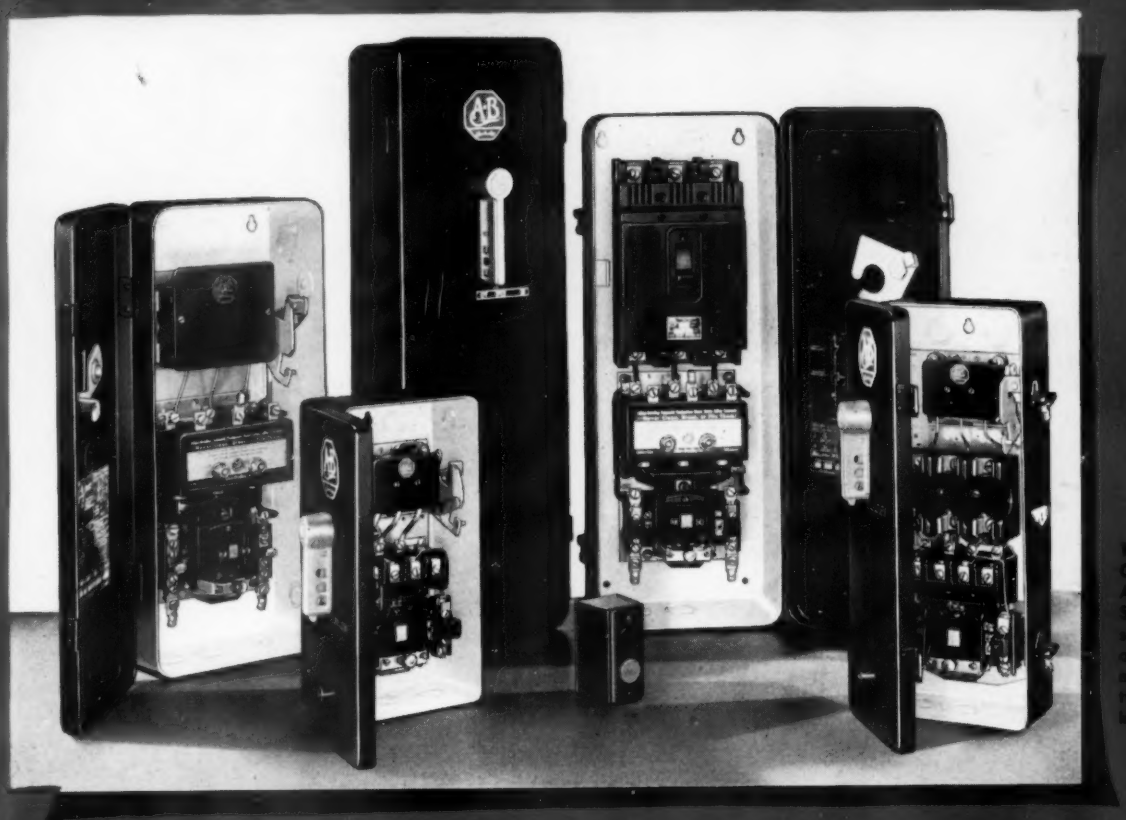
Ruthman Gusher Coolant Pumps are installed as standard equipment by many of the leading manufacturers of machine tools all over the world. Experience has taught them that Ruthman Coolant Pumps give dependable long service with minimum maintenance cost.

These satisfied customers are your best guarantee of the service which Ruthman Gusher Coolant Pumps will give you. Specify Ruthman Pumps for all your coolant needs.

Model 11020-A

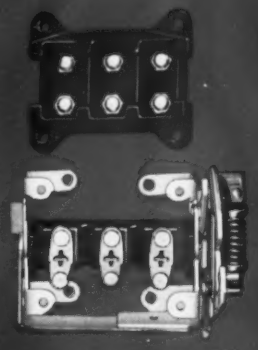
There's a Gusher for Every Coolant Requirement
Write Us Now For Catalog

THE RUTHMAN MACHINERY CO.
1809 READING ROAD
CINCINNATI 2, OHIO
The "GUSHER"—A Modern Pump For Modern Machine Tools

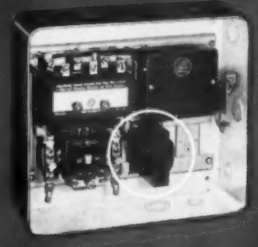


There is an A-B Combination Across-the-Line Starter for every service. It is recognized as the most up-to-date type of starter installation.

A Full Line of
COMBINATION STARTERS
for Machine Tool Applications



A-B Disconnect Switches have double break, silver alloy contacts. All knife switch troubles are eliminated.

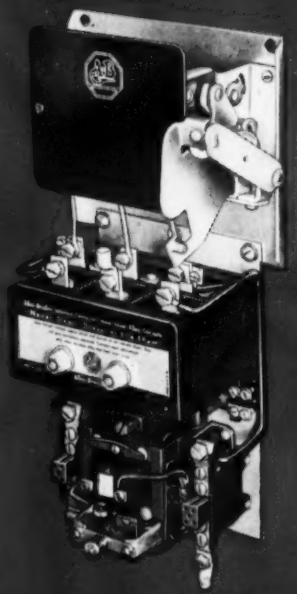


Can be supplied with step-down transformers for low voltage pilot control on 440, 550, and 600 v power lines.

Allen-Bradley Combination Starters consist of two units in a single cabinet—(1) an Allen-Bradley solenoid across-the-line starter and (2) a disconnect unit, which may be either a manually operated disconnect switch or a circuit-breaker. These starters are popular with machinery manufacturers, because they save space, they are easy to install, and they provide added safety features for the operator. Furthermore, they provide complete control with an improvement in the appearance over the separate units.

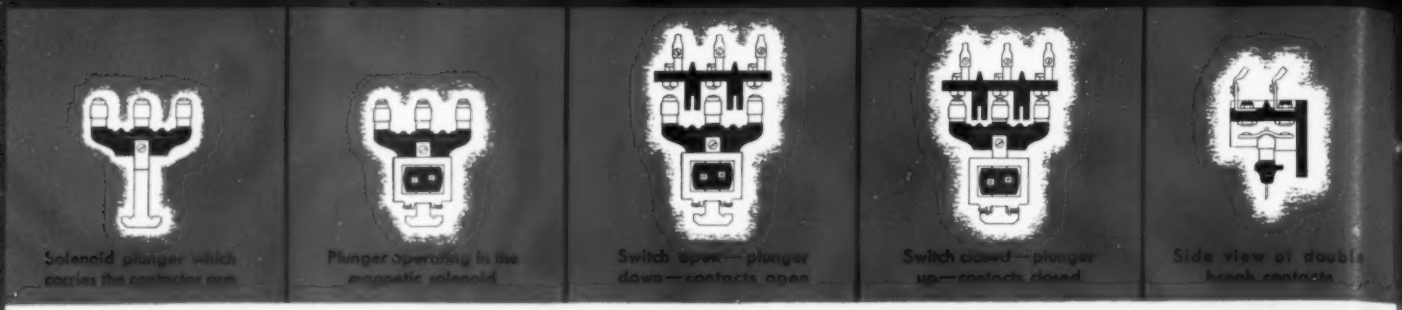
These starters are available up to 100 hp, 220 v; and 200 hp, 440-550-600 v, in seven types of enclosures which meet every service requirement. Disconnect lever is in front of cabinet, which permits close grouping of starters. Send for Bulletin 712-713.

Close-up of A-B Bulletin 712 Combination Starter. Disconnect unit is mechanically interlocked with disconnect lever so cabinet cannot be opened unless disconnect switch is in the "OFF" position.

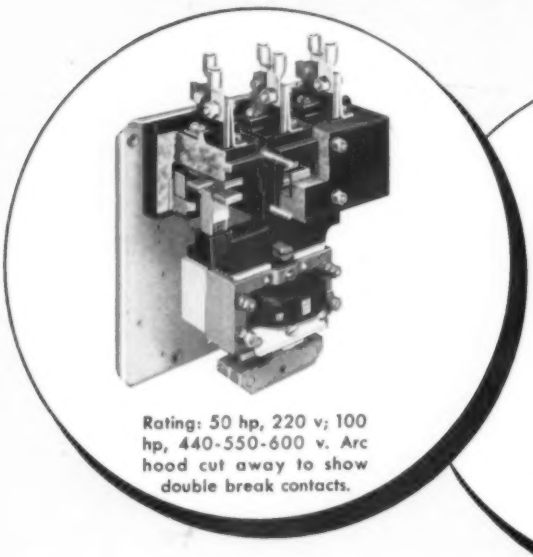


A-B Quality

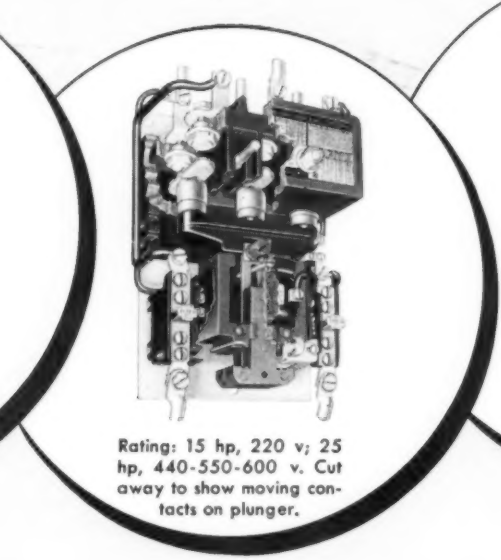
ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY


Solenoid plunger which carries the contactor arm
Plunger operating in the magnetic solenoid
Switch open—plunger down—contacts open
Switch closed—plunger up—contacts closed
Side view of double break contacts

ONLY ONE MOVING PART
in ALL Allen-Bradley Solenoid Starters



Rating: 50 hp, 220 v; 100 hp, 440-550-600 v. Arc hood cut away to show double break contacts.



Rating: 15 hp, 220 v; 25 hp, 440-550-600 v. Cut away to show moving contacts on plunger.

Rating: 5 hp, 220 v; 7½ hp, 440-550-600 v. Arc hood lifted to show silver alloy contacts.

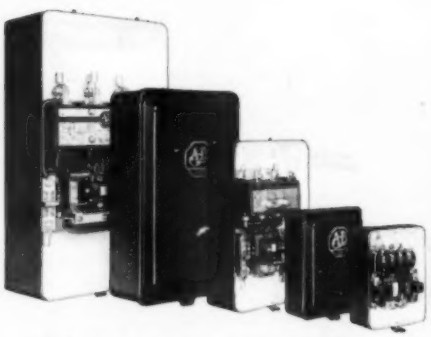
SIMPLICITY—The Keynote to Trouble-free Design

It is a fundamental fact that when you eliminate "parts" you eliminate "trouble"... when you do away with pivots, pins, bearings, flexible jumpers, and other gadgets in starters you do away with trouble-breeders.

Since the A-B solenoid starter has only ONE moving part . . . the one-piece solenoid plunger . . . it is the simplest starter on the market and therefore the most trouble-free.

Furthermore, the double break, silver alloy contacts never need filing, cleaning, or dressing. You can install an Allen-Bradley solenoid starter . . . and forget it.

Is it any wonder that A-B solenoid starters have set the standard for starter design and performance? Ask the machine tool manufacturers . . . more and more machine tools are A-B equipped. If you want trouble-free operation . . . just specify A-B.



Allen-Bradley solenoid across-the-line starters are available in five sizes and seven types of enclosures to meet all service requirements. White cabinet interiors make wiring easy in dark corners.

Allen-Bradley Company
1316 South Second Street
Milwaukee 4, Wisconsin

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

Mister, now's the time to figure on

Horsepower by Howell

The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available. *Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.*

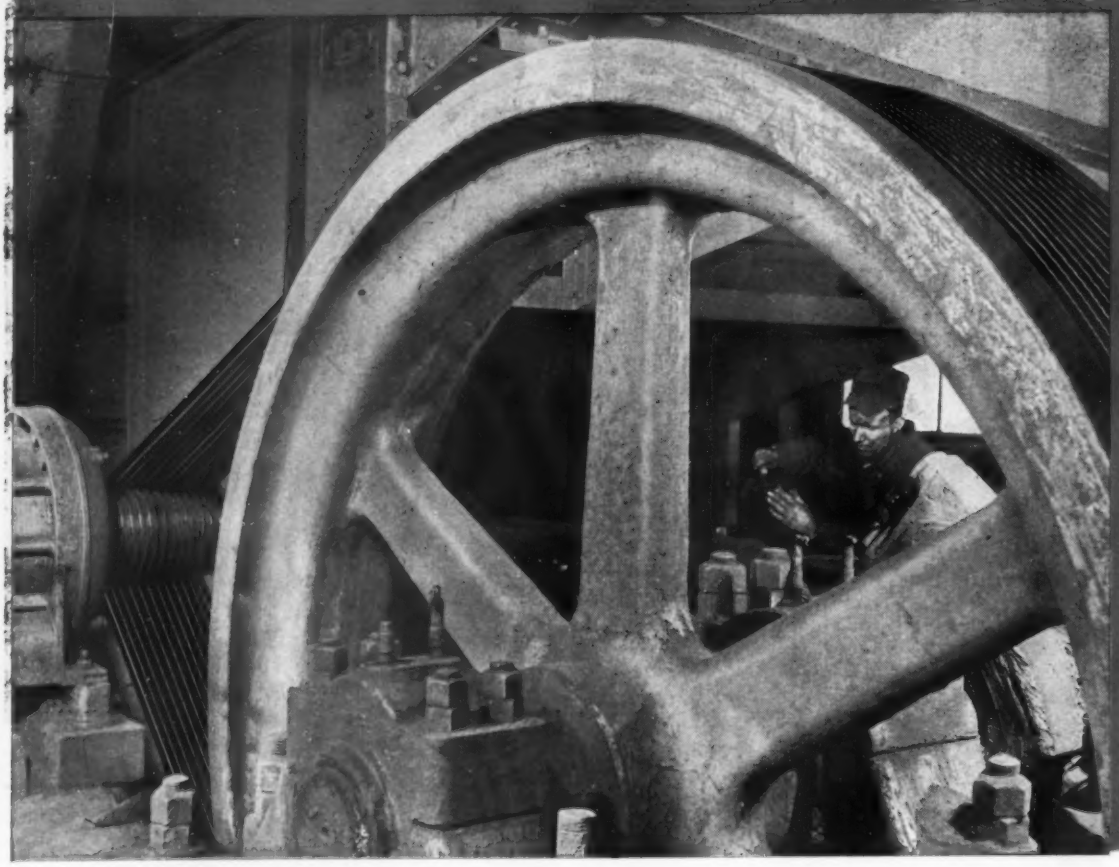
Years of building Howell Motors, to meet the exacting requirements of the automotive, dairy, food and other important industries, have enabled us to make them better than ever. Today, as always, Howell Motors are quality-motors. They are quiet-operating because they are statically and dynamically balanced. They are better performing because they are built of the finest materials—copper or bronze rotors—and completely insulated. They are trouble-free on the job because they are designed for the toughest tasks in industry—consequently, they perform better on all jobs. For your postwar need in specialized or standard motors, from ¼ to 150 h.p., phone the nearest Howell Representative today.

HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915

SCREENING COAL
...AT 400 TONS AN HOUR!



•ABSORBING SHOCKS—
•UNMINDFUL OF DUST—
•120 HOURS WITHOUT REST!

Twelve Dayton V-Belts driving this gigantic pulley to keep it spinning 24 hours a day, five days a week—120 hours at a stretch—operate the huge coal screen which handles 400 tons of coal an hour. This power drive is subjected to an intermittent, shock-type load that puts the Dayton V-Belts to a most severe test.

But tough as the job is, it's all in a day's work for Dayton V-Belts. They are built to absorb shock-type loads, heavy starting and stopping loads; built to withstand heat, dirt, humidity and other difficult operating conditions. They can do these things because they are designed from research experience covering 40 years of manufacturing natural and synthetic rubber products. No wonder Dayton V-Belts can stand the gaff of the most gruelling power transmission jobs.

Your Dayton V-Belt Distributor will gladly show you how you can make these Dayton V-Belt advantages pay dividends for you—how Daytons can save you space, eliminate noise, and bring power transmission maintenance costs to a minimum. It will take only a minute to call him. Do it today!

THE DAYTON RUBBER MANUFACTURING COMPANY
DAYTON 1 • OHIO

V-Belts by

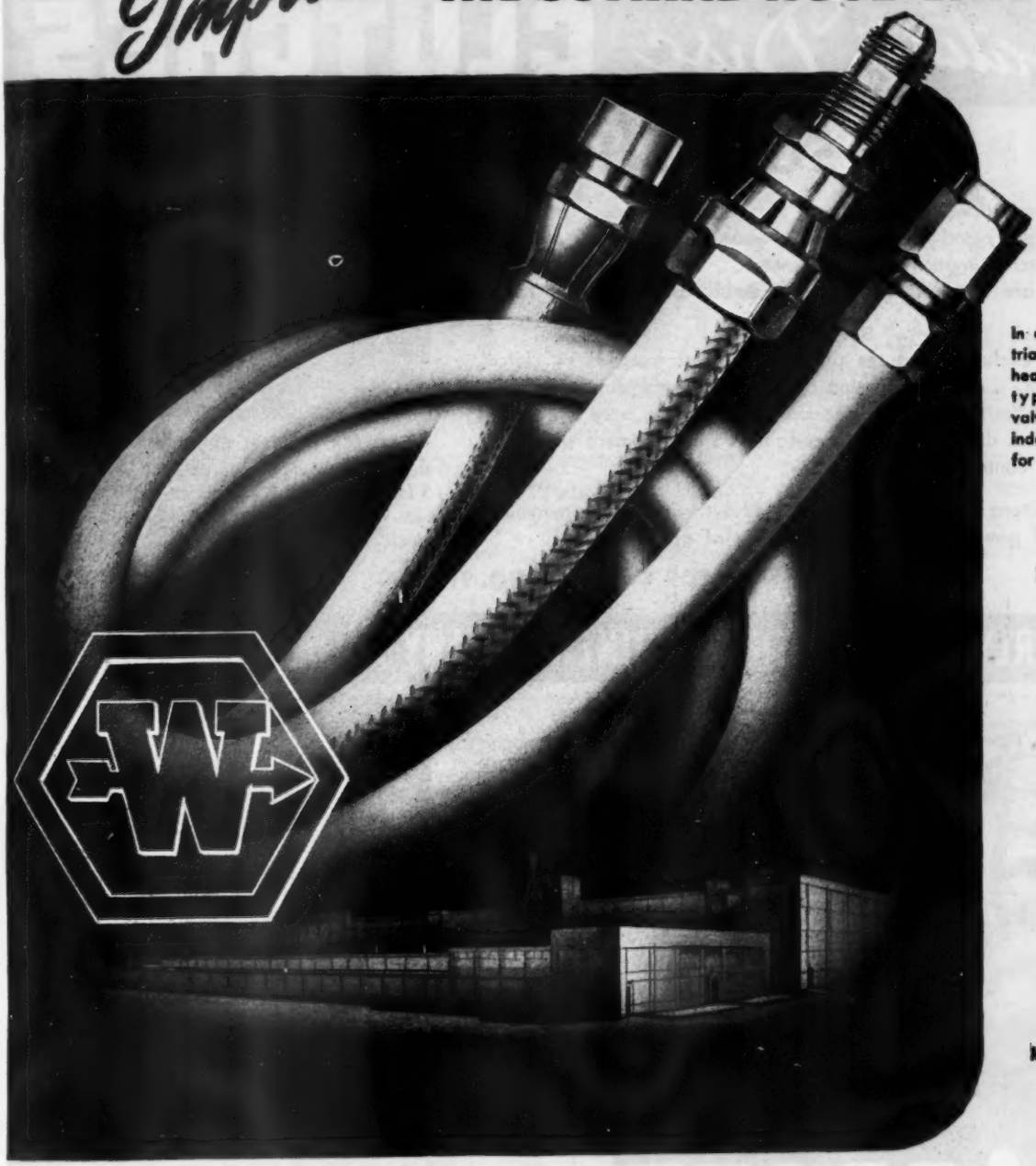
Dayton Rubber

REG. TRADE MARK — THE DAYTON RUBBER MFG. CO.

THE MARK OF TECHNICAL EXCELLENCE IN SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

Improved INDUSTRIAL HOSE LINES



In addition to industrial hose, Weatherhead plants make all types of fittings, valves, hydraulic cylinders and other parts for these industries:

AUTOMOTIVE
★
REFRIGERATION
★
RAILROAD
★
MARINE
★
FARM EQUIPMENT
★
ROAD MACHINERY
★
DIESEL
★
L. P. GAS
★
APPLIANCE MANUFACTURERS

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND 8, OHIO
Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

New uses are being found daily for the application of our *improved* industrial hose lines on machinery of all kinds. We manufacture hose assemblies of all types to withstand pressures up to 10,000 P.S.I. They can be equipped with either permanent crimped ends or with re-usable, quick-attachable hose ends. For information or literature write or phone any Weatherhead branch office.

BRANCH OFFICES: NEW YORK • PHILADELPHIA • DETROIT • CHICAGO • ST. LOUIS • LOS ANGELES

TRADE
MAXITORQ
MARK
Floating Disc CLUTCHES

SO LONG LIVED

With parts so well designed, so accurately machined, so scientifically processed, there's little to wear in a Maxitorq Multiple Disc Clutch. Simplicity is the keynote . . . so much so that NO TOOLS are required for either assembly, adjustment or take-apart.

Several exclusive features prevent the past troubles of clutch operation . . drag, abrasion and heating, for instance. Positive "in" and "out" is assured. Manual adjustment is easy and accurate. Quick disengagement is certain . . . engagement with light pressure control.

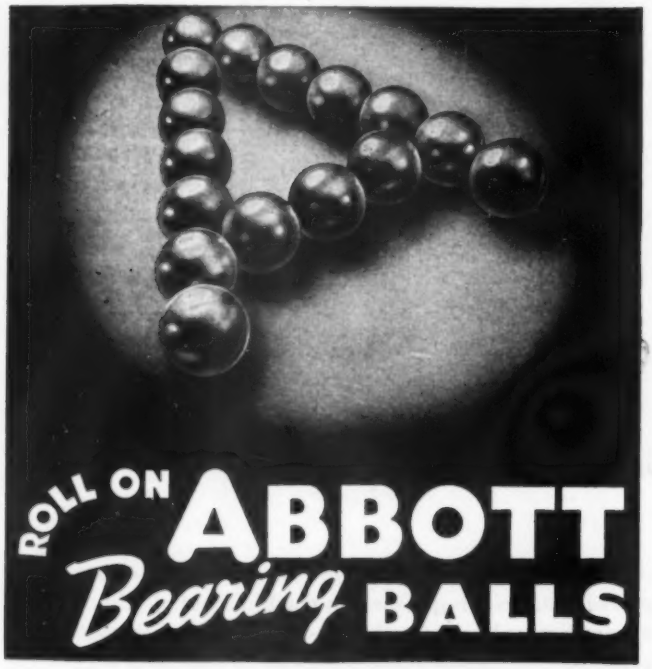
The Maxitorq will give long service without trouble, with minimum waste of power, with utmost efficiency of operation.

DOUBLE TYPE CLUTCH

Submit your clutch problems . . . 1/4 to 15 H.P. at 100 R.P.M. . . . to our engineers for solution. Special sizes to order.

SEND FOR CATALOG NO. 91

THE CARLYLE JOHNSON MACHINE COMPANY · MANCHESTER, CONNECTICUT



ROLL ON ABBOTT Bearing BALLS

Their "Built-in" STAMINA assures UNINTERRUPTED PERFORMANCE

SPECIFY "ABBOTT" and be sure

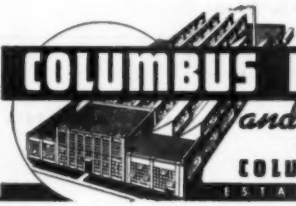
THE ABBOTT BALL COMPANY

HARTFORD 10 CONN., U. S. A.

TWO HEADS ARE BETTER THAN ONE

The combination of your ideas and our ideas mean quality and cost reductions—through finer tools, dies, jigs, etc. Our engineers and tool designers are ready to interpret your plans and carry them through to a practical and successful conclusion.

JIGS • FIXTURES • SPECIAL TOOLS
BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
PUNCHES AND DIES



COLUMBUS DIE · TOOL and Machine Co.

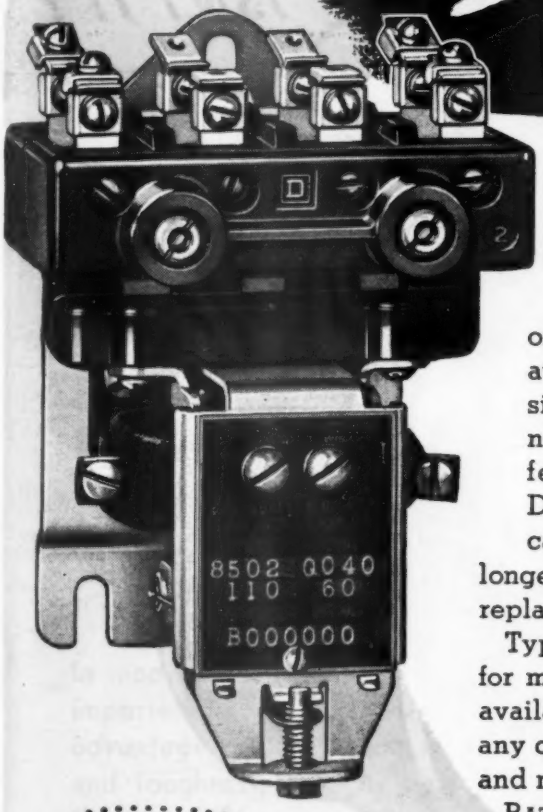
925 CLEVELAND AVE.,

COLUMBUS 1 OHIO

ESTABLISHED 1908

- STRAIGHT LINE VERTICAL ACTION
- ACCESSIBLE TERMINALS
- CONVERTIBLE CONTACTS
- NEW FLEXIBILITY
- LONGER LIFE
- SMALL SIZE

Now! THE FEATURES YOU'VE WANTED IN SIZE 00 CONTACTORS!

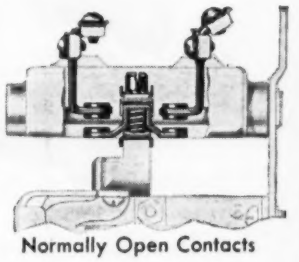


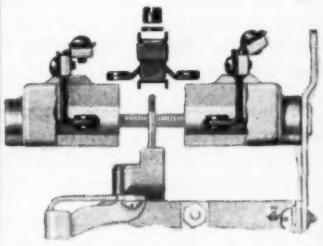
Square D's new Type Q brings new flexibility—longer life-plus!

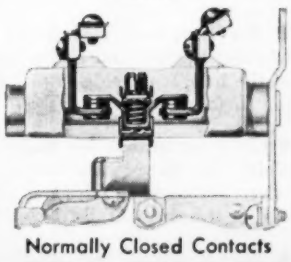
• No other Size 00 Contactor has *all* the advantages of this new Type Q. Compactness has been achieved at no sacrifice of accessibility. All terminals are accessible and conveniently located for group mounting. A new type of contact bar and guide is one of several features which assure substantially increased life. Double-break, silver contacts can be readily replaced if prolonged, frequent operation makes replacement necessary.

Type Q Contactors are suitable for mounting on steel panels—are available with two to six poles in any combination of normally open and normally closed contacts.

RATINGS, 600 volts A.C. max.; 10 amperes open, 9 amperes enclosed.


Normally Open Contacts


Movable Contact Assembly removed and ready to be inverted


Normally Closed Contacts

Convertible Contacts

EASILY CHANGED FROM NORMALLY OPEN TO NORMALLY CLOSED

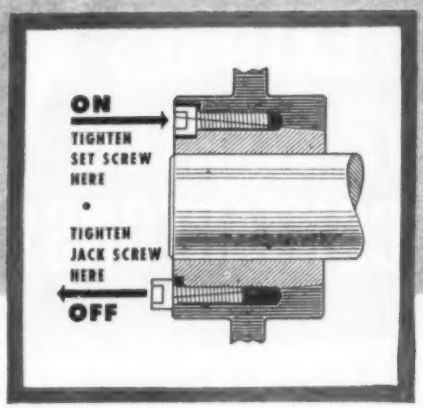
NO ADDITIONAL PARTS NEEDED. As shown in the sectional views at the right, any pole can be easily changed from normally open to normally closed or vice versa. Simply remove the movable contact assembly, turn it over and reassemble it. No additional parts are involved. Stock contactors can be changed, easily and quickly, to meet special requirements.

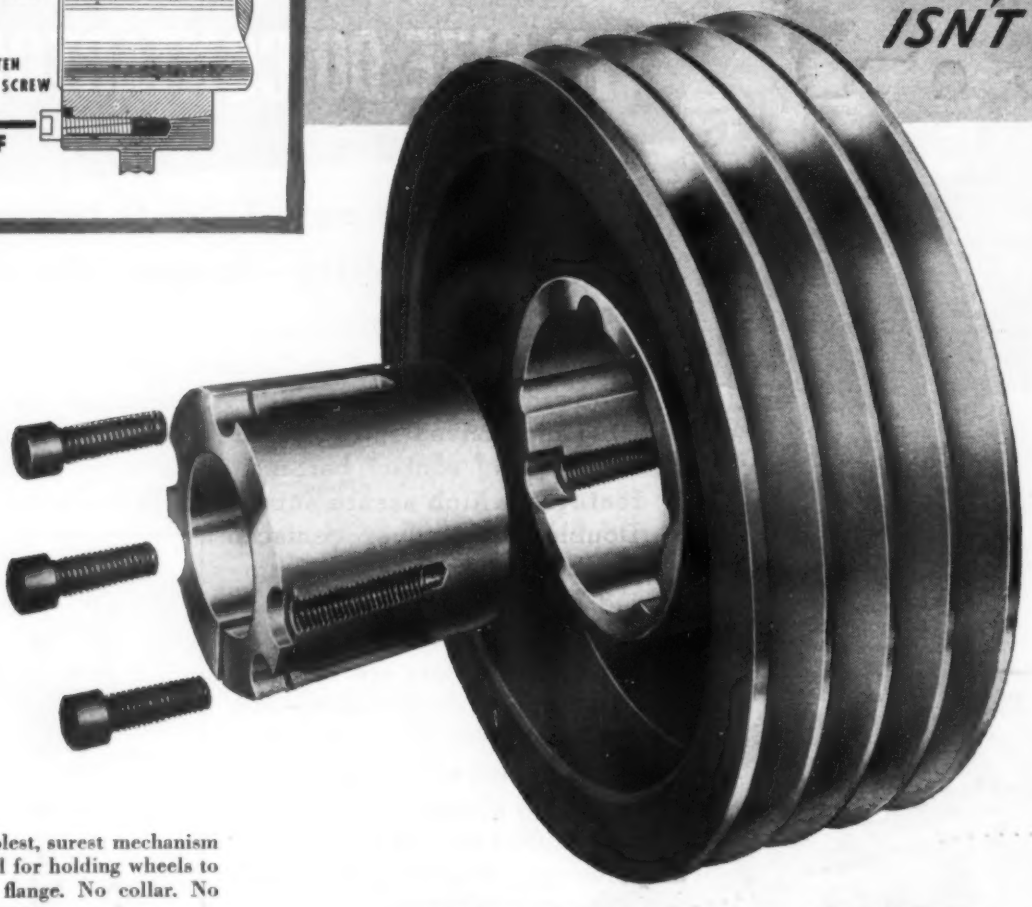
See your nearby Square D Field Engineer for further details, or write for Bulletin #203, Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Simple, ISN'T IT?





- The simplest, surest mechanism ever devised for holding wheels to shafts! No flange. No collar. No protruding parts.
- The Taperlock Sheave mounts as a complete unit. Slip it on, line it up and tighten *while sighting*. It's in place on the first try!
- The bushing is wedged into the sheave by means of set screws—with a firmness equivalent to a shrunk-on fit—whether the shaft is standard or normally undersize.
- The Taperlock runs *true*. The bushing extends the entire length of the hub; it provides a *full* bearing surface.
- Close mountings are made possible. No flange nor collar nor other device is required at either end of the sheave hub.
- The Taperlock "unlocks" with less effort than any other sheave—due to its special taper.
- Taperlock Sheaves will be stocked by Dodge Transmissioneers in principal cities—and will be available in ALL stock sizes.

New TAPER-LOCK *Sheave*

PATENT APPLIED FOR

Easy on—easy off—locks fast to the shaft! ALL the advantages you've ever dreamed about in a sheave are *here*—in the simplest, quickest acting mechanism ever developed for the purpose!

For full details call your local Dodge Transmissioneer. You'll find his name listed under "Power Transmission Equipment" in your classified telephone directory. Or write

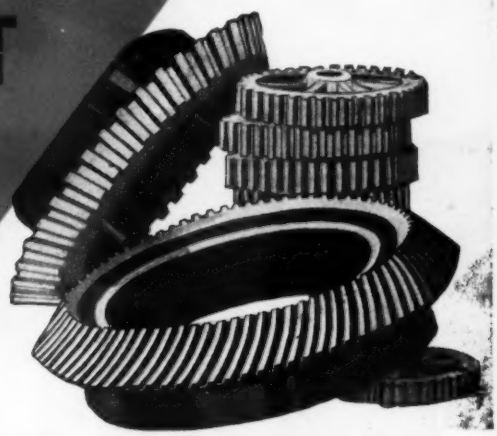
DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

DODGE
MISHAWAKA

SIGN OF THE DODGE TRANSMISSIONEER
There are 257 Dodge factory graduate Transmissioneers, located in principal cities, to show you NEW and BETTER ways of transmitting power. See your local classified telephone directory.

FORGINGS Save WEIGHT and SPACE!

Over 31% in weight was saved by forging the internal gear and sleeve shown, part for an electric hoist. Machining time was reduced and production greatly increased.



About 68% less material was required when bevel gears were forged instead of machined from bar stock. Machining time, too, was greatly reduced.

In modern machines, weight reduction is an important advantage. *Forgings provide this advantage.* By producing maximum strength and toughness, the forging process permits the use of thinner metal sections, resulting in parts of less weight. Where this characteristic is applied to a number of parts, the weight of the entire unit may be substantially reduced. At the same time metal bulk is reduced; an important consideration in the design of many machines.

Savings in weight—combined with ultimate strength — through the use of hundreds of forgings in a single plane have been transformed into greater flying speed and range, more maneuverability and heavier loads. Forgings have played a key part in the rise of American air power and the decline of that of the enemy.

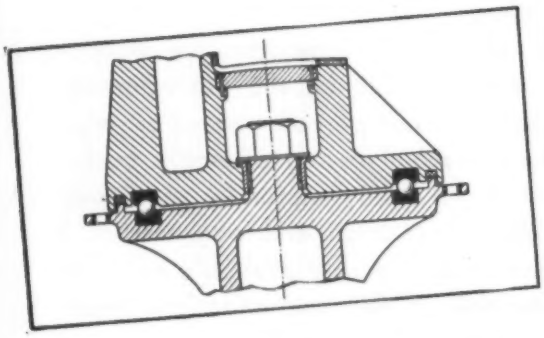
In the machines of tomorrow, the weight savings made possible by the use of more forgings will have comparable value. Forgings also reduce machining and assembly costs, and enhance the safety factor by providing parts of ultimate strength and toughness.

We have ample facility available *now* for the production of flat die and light drop forgings. Your inquiry is solicited.

KROPP FORGE COMPANY
5301 W. Roosevelt Road
Chicago (50), Illinois
Engineering Representatives in Principal Cities

SERVING INDUSTRY SINCE 18 31 OVER 100 YEARS — KROPP FORGE CO — KROPP — ARMY ★★ E ★★ NAVY

BEACHING GEAR OF MARTIN "MARINER" RIDES ON TORRINGTON BEARINGS



X-section shows application of Torrington Ball Thrust Bearing to beaching gear of Martin PBM Mariner. Sturdy construction and efficiency of lubrication assure the big ship complete "maneuverability" ashore.

When seaplanes "step ashore," it is on sturdy and free-moving beaching gear that assures complete safety and ease of "maneuverability."

For the beaching gear of their famous PBM Mariner, Glenn L. Martin engineers specify rugged, corrosion resistant Torrington Ball Thrust Bearings. Only 16" across, and containing 63 balls of ¾" diameter, these modern *anti-friction* bearings easily carry the full weight of the ship, enabling the wheels to pivot beneath it like giant casters. Construction of balls and bearing races of stainless steel assures freedom from corrosion due to salt water.

The beaching gear of the giant Martin "Mars" also uses special 31.625 inch diameter Torrington Ball Thrust Bearings.

Torrington's Bantam Bearings Division specializes in the design and construction of bearings to meet heavy-duty requirements. If you have a bearing problem, routine or unusual, our engineers will help you to solve it quickly and efficiently.

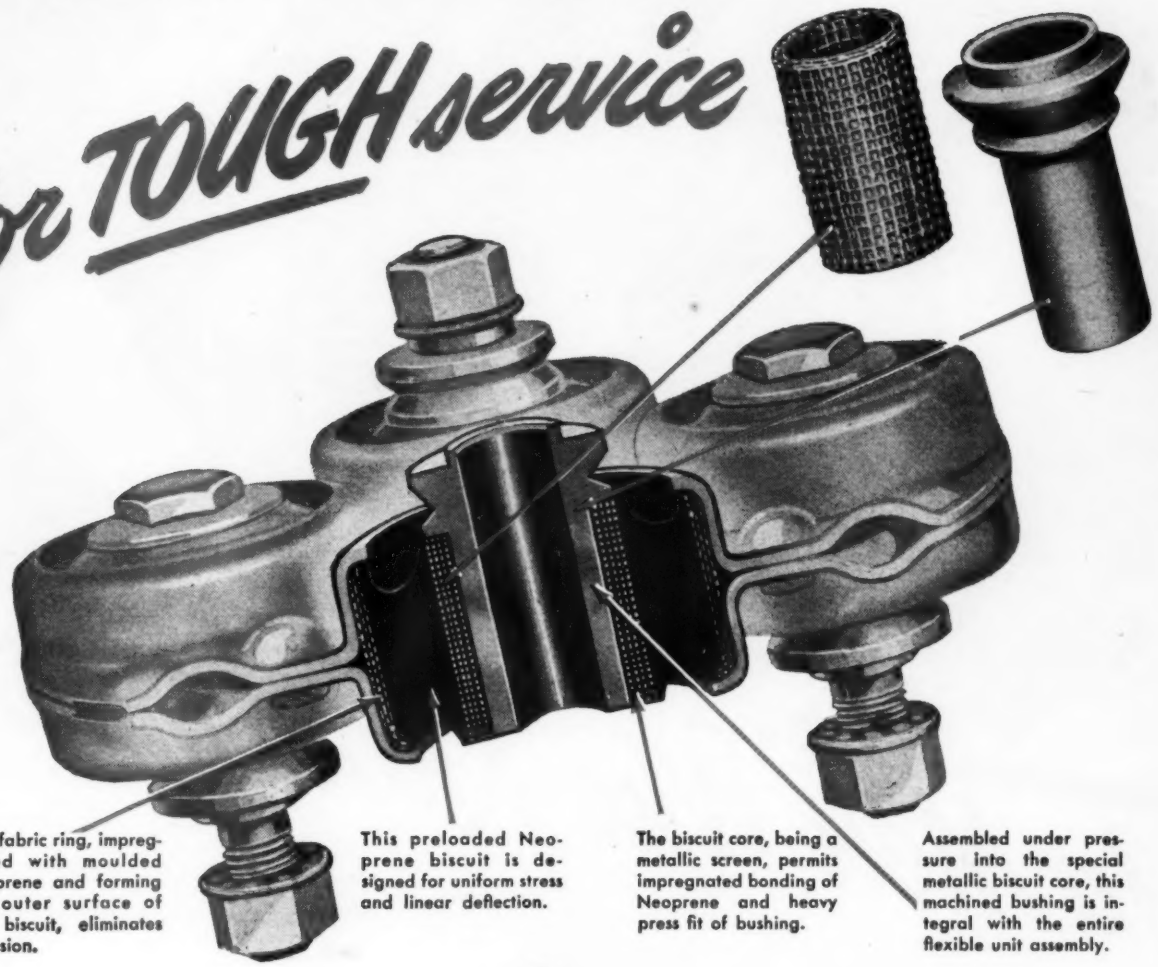
THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

TORRINGTON BEARINGS

STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

MORFLEX COUPLINGS

for TOUGH service



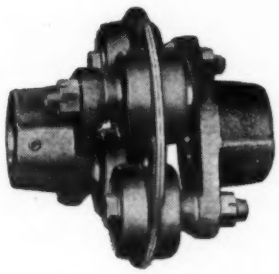
This fabric ring, impregnated with moulded Neoprene and forming the outer surface of the biscuit, eliminates abrasion.

This preloaded Neoprene biscuit is designed for uniform stress and linear deflection.

The biscuit core, being a metallic screen, permits impregnated bonding of Neoprene and heavy press fit of bushing.

Assembled under pressure into the special metallic biscuit core, this machined bushing is integral with the entire flexible unit assembly.

Morflex Couplings withstand severe punishment under the most adverse conditions. Utilizing exclusively Morse-designed rubber biscuits preloaded in assembly, they require no lubrication and are sealed against dirt, dust, and weather. Positive direct drive with no power loss, Morflex Couplings with their inherent flexibility reduce bearing wear, permit slight angular misalignment, ease thrust and torsional loads, and absorb shocks, uneven impulses and vibration. They are constructed to eliminate all action between metal-to-metal surfaces; are therefore trouble-free and long-lived. In short, they are engineered for tough, dependable service. Call the Morse engineer or write Morflex Dept. Detroit for information on your specific applications.



Oval Flange type supplied in eleven sizes from 8-foot pounds to 725-foot pounds of torque.

ARMY E NAVY

SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE Roller and Silent CHAINS

MORSE CHAIN COMPANY • ITHACA, N.Y. • DETROIT 8, MICH. • A BORG-WARNER INDUSTRY

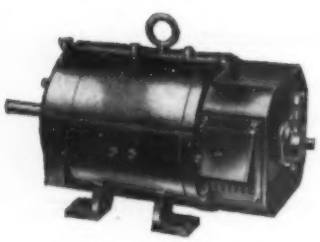
To Men Who Know Motors

. . . we could end our message here!

To men who know motors, a picture like this is worth the proverbial ten thousand words. It speaks with convincing eloquence of craftsmanship to which any motor builder could point with pride.

If you visit Star's modern plant, you'll see scores of examples of the same painstaking craftsmanship that pays off in outstanding performance for Star customers.

Star not only builds motors well, but also takes leadership in design. Star pioneered ball bearing motors . . . led in welded steel construction . . . developed the famed Star Built-in Magnetic Disc Brake for motors . . . pioneered in the field of gear-motors.



Integral HP Motor for Direct Current

Whether you need special or standard motors, 1/8 to 200 H.P., it will pay to learn why so many critical buyers specify "Star". Some standard motors are ready for early delivery. Star Electric Motors Co., 200 Bloomfield Avenue, Bloomfield, N. J.

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

Contact KAYDON *of Muskegon*

FOR ALL TYPES OF BALL AND ROLLER BEARINGS 4" BORE TO 120" OUTSIDE DIAMETER

The huge spindle of this 13-ton SMALLEY-GENERAL Thread Miller runs in Special KAYDON Tapered Roller Bearings, 24x30x2.125".
THE NO. 44 MB SMALLEY-GENERAL MASTER THREAD MILLER USES KAYDON PRECISION TAPER BEARINGS

Companions in QUALITY *and* PRECISION

WITH its 18½" hole through main spindle, and with sufficient swing to take care of 8" Howitzers, 155 m/m and 4.7 guns, this SMALLEY-GENERAL machine is milling threads formerly considered impossible . . . up to 1" pitch, 34" inside and 24" outside diameters!

Teaming up with thread-miller engineers of the Smalley-General Company, KAYDON made the special high-precision tapered roller bearings with a very thin cross section, which presented unusual problems in accuracy. This successful teamwork is typical of progress that can be achieved by experienced "companions in quality and precision".

KAYDON, specializing in engineering and production of all types and sizes of ball and roller bearings from 4" bore to 120" O.D., also offers complete facilities for atmospheric controlled heat treating, flame hardening, precision heat treating, salt bath high speed tool hardening, microscopy, physical testing, and metallurgical laboratory services.

Counsel in confidence with KAYDON. Capacity is available now for production of all types and sizes of KAYDON Bearings. Look ahead — plan ahead — with KAYDON.

KAYDON *Types of Standard or Special Bearings:*
Spherical Roller • Taper Roller
Ball Radial • Ball Thrust
Roller Radial • Roller Thrust

THE KAYDON ENGINEERING CORP.

MUSKEGON · MICHIGAN

New in Name . . . Old in Experience

Use Udylite

UNIFIED SERVICE

Udylite is organized and equipped to meet all the requirements of those metal finishers engaged in electroplating, anodizing and polishing. This unified service *Includes:*

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Regardless of what equipment, controls, supplies or chemicals you need, Udylite can supply you.

FACTORY

Two large manufacturing plants build the standard and special equipment used in metal-finishing.

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Udylite maintains a completely equipped service laboratory, in charge of experienced electrochemists, to test your solutions periodically in order to keep them at full efficiency—this at no cost to you.

PILOT PLANT

A pilot plant is available to test under actual plating room conditions, any new procedure you have worked out or which has been developed by Udylite's engineers.

ENGINEERING DEPARTMENT

Udylite's mechanical engineering staff is likewise available to design any type of plating equipment to meet your specific requirements.

RESEARCH

Udylite's research engineers, working in their own laboratory, are continuously engaged in projects to further the improvement of metal-finishing processes and equipment. Take advantage of their findings.

You get all these advantages

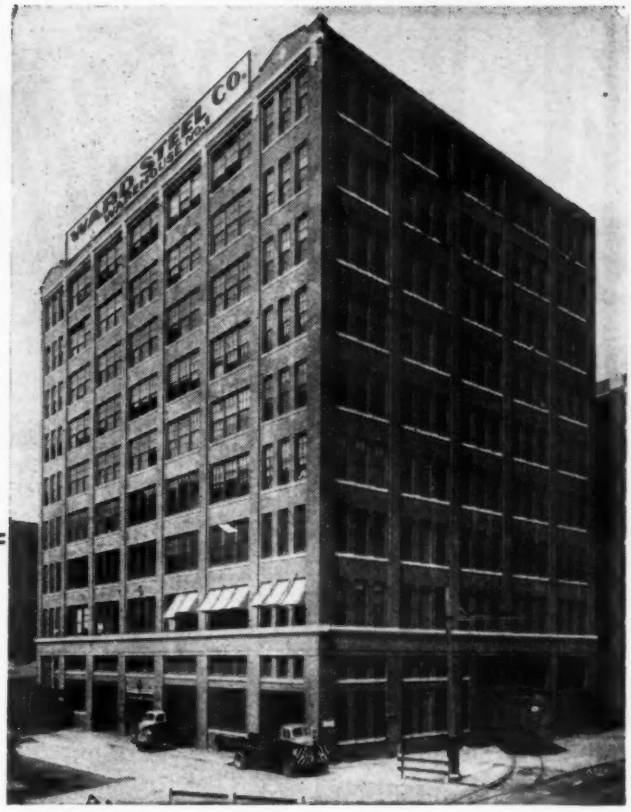
WHEN YOU STANDARDIZE ON UDYLITE PRODUCTS

THE Udylite CORPORATION

1651 EAST GRAND BOULEVARD

DETROIT 11, MICHIGAN

OFFICES IN PRINCIPAL CITIES



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COLD DRAWN SEAMLESS STEEL TUBING & ELECTRIC WELDED TUBING

FLAT ROLLED SPRING STEELS—(TEMPERED & UNTEMPERED)

COLD ROLLED—STRIP, FLAT WIRE & SHEETS

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Sales Representative and Distributors for

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ALLEN

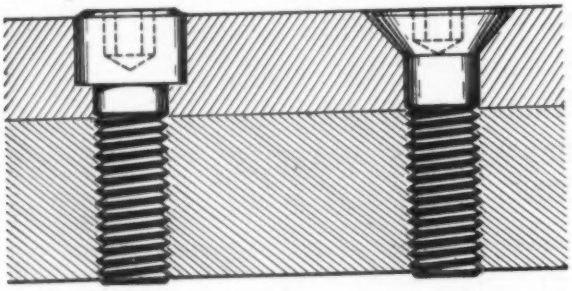
FLAT HEAD CAP SCREWS

V-head design fits counterbored hole with *no gap* between screw head and surrounding metal. This gives frictional grip and a locking rigidity, reinforced by the tightest of set-ups possible only by powerful wrenching with an Allen Hex Key.

The screws are "pressur-formd" of ALLENOY steel, with uncut metal fibres shaped to the head. Threads also are *pressur-formd*, with tolerances held to a high Class 3 fit.

ALLEN FLAT HEAD CAP SCREWS

set up *flush* in holding comparatively thin plates or superposed parts, without weakening the metal with deep countersink.



Above diagram shows how flush surface is achieved with shallow countersink as compared with ordinary socket head cap screw. Note more binding surface under the head than is had with a fillister or cheese-head type. The angle helps lock screw in place by drawing down on a conical surface.

Your local Industrial Distributor supplies also Allen Socket Head Cap Screws, Hollow Set Screws, "Tru-Ground" Shoulder Screws and "Tru-Ground" Dowel Pins. Ask him for samples and details.

THE ALLEN MFG. COMPANY
HARTFORD, ★ ALLEN ★ CONN.

FULL SPEED AHEAD

★ with a Pioneer Pump supplying one of the important factors affecting the speed of metal removing operations. The major conditions governing cutting speed are the composition of stock and tool, feed and depth of cut, the coolant used and the method of getting it to where cutting action is taking place.

Pioneer Pumps, the most efficient coolant distributors in use today, send a steady stream of liquid to the point where it is needed. Most cutting operations will show increased feet-per-minute production when the proper coolant is supplied by a Pioneer Pump.

Among Pioneer's 400 standard models you are sure to find the pump which will give the "full speed ahead" signal to your machines.

PIONEER MODEL V

normally rests directly on bottom of tank or reservoir, but tank brackets and flanges are available to facilitate mounting on edge, side or top. Foot grille provides clearance for unobstructed flow and prevents entrance of large pieces of foreign matter. Outlet boss may be specified 90° or 180° from position shown.

PIONEER Pumps
HIGH EFFICIENCY • LOW POWER CONSUMPTION
GREATER VOLUME AND LESS MAINTENANCE

Pioneer Pump & Manufacturing Co.
19651 JOHN R ST. • DETROIT 3, MICHIGAN

Prove Your Products' Guarantee with built-in VEEDER-ROOT "COUNTROL"

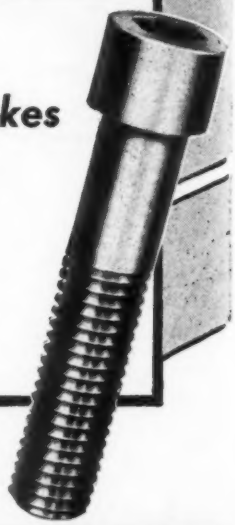
It's as simple as this: Build into your machine or product, as an integral part, a Veeder-Root Counting Device that registers strokes, turns, pieces, trips or any other units of performance . . . mechanically or electrically. Then your customers can *see* when your guarantee period is reached . . . for the Facts-in-Figures are right there in front of them in plain, bold black and white. So there's no room for argument, no needless loss of goodwill or future business through lack of positive proof. In fact, there are cases in which inexpensive Veeder-Root Devices have saved hundreds, even thousands, of dollars.

There are Veeder-Root Devices that will record the exact number of performance-units constituting the guarantee period. And then these devices will go on proving to your customers that they're getting all the performance you built into your product. You are invited to take "*Count*sel" with Veeder-Root engineers, who will show you just how you can protect and profit yourself by attaching to your product a tag like this one at the right.

Veeder-Root Inc., Hartford 2, Conn.
In Canada: Veeder-Root of Canada, Ltd., Montreal
In England: Veeder-Root Ltd. (New address on request)

Why are *Mac-its* used on Extra Tough jobs?

Because . . .
Mac-it Process makes
them STRONGER
more UNIFORM
more ACCURATE



Mac-it Products Include: Socket Head Cap Screws, Hollow Set Screws, Hexagon Head Cap Screws, Square Head Set Screws, Stripper Bolts, Hexagon Socket Pipe Plugs.

STRONG, CARLISLE & HAMMOND CO. • Cleveland 13, O.

WHEN YOU NEED PRECISION-BUILT SMALL PUMPS . . . Specify TUTHILL

For High Pressure Service . . . IT'S MODEL CK

For machine tools, engines and hydraulic mechanisms, Tuthill Model CK high pressure pump offers dependable performance in a compact package. This internal gear rotary pump is designed to save space, material and money. Sizes from 1 to 50 g.p.m. Pressures up to 400 p.s.i. Direct motor drive, V-belt units and integral drives. Write for Model CK bulletin.

Serving Army • Navy
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DANLY
Socket-Head Cap Screws

"Danly Knurled" is noted for high quality and accuracy. Specify it by name "Danly Knurled."

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BEVEL GEAR RATIO
can be changed by merely changing the pinion.

BILGRAM GEAR & MACHINE WORKS
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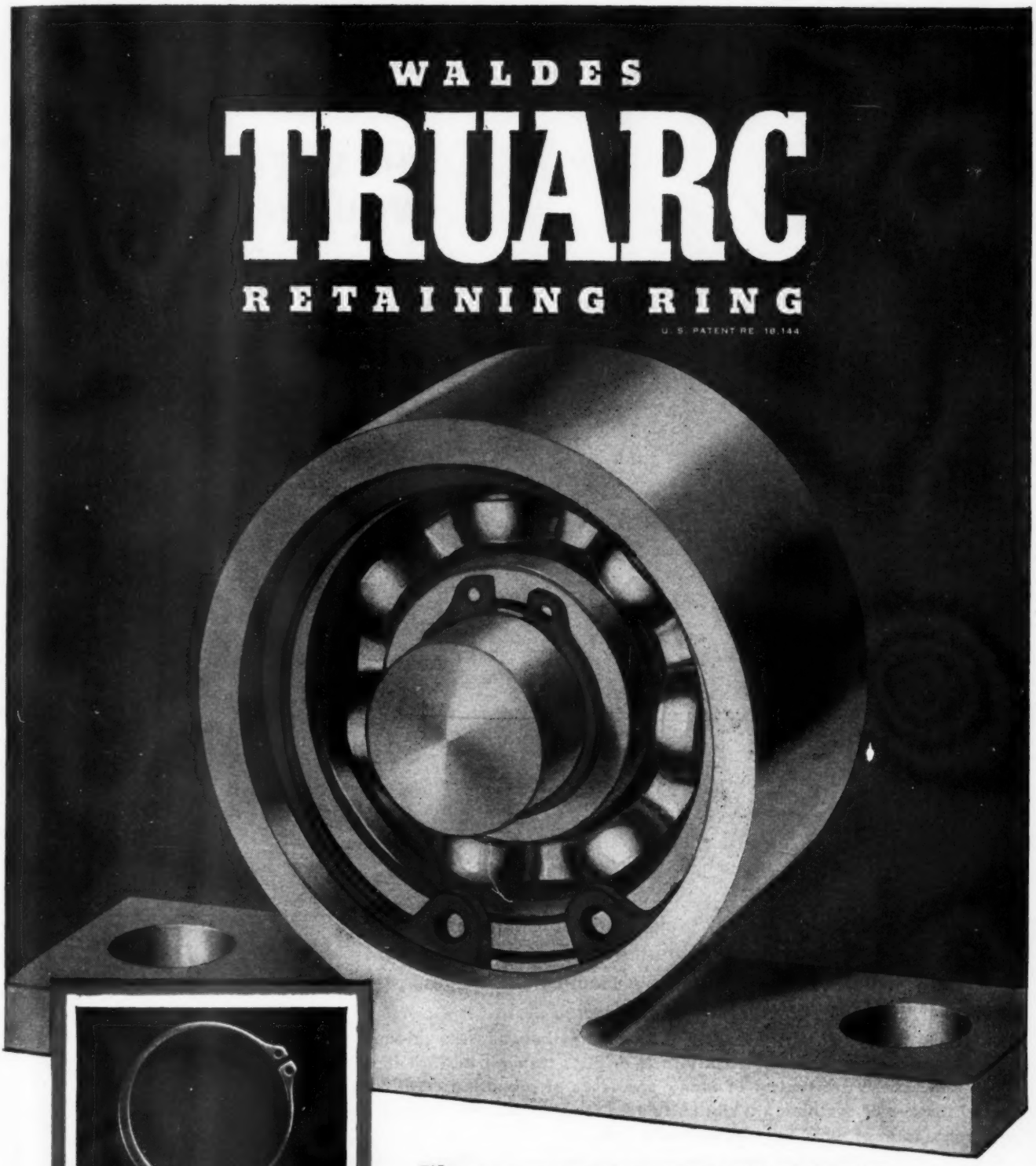
WALDES
TRUARC
RETAINING RING

U. S. PATENT RE 18,144

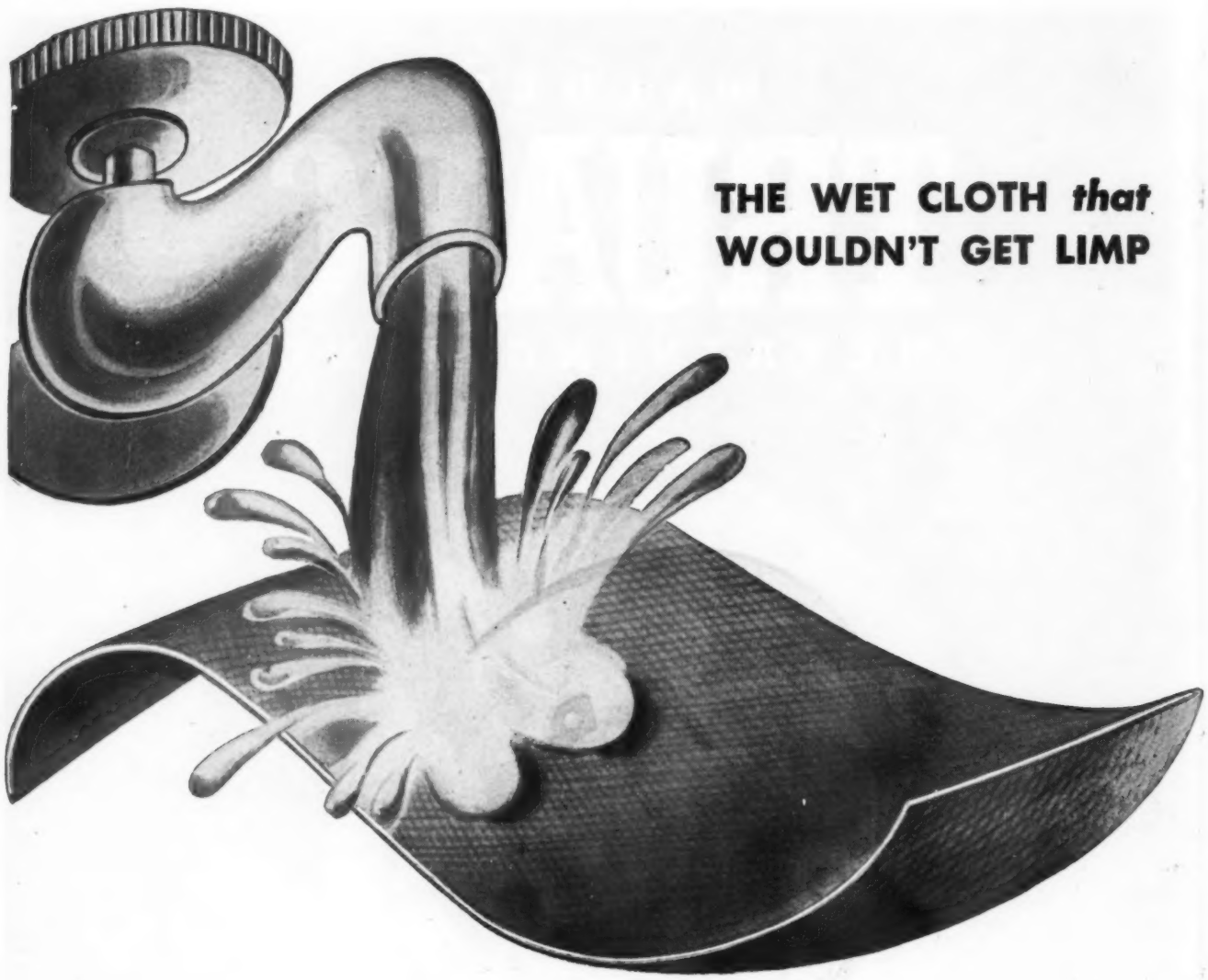


Waldes Truarc expands or contracts without distortion and without permanent set, fitting tight all around the groove. It offers important advantages over shoulders, nuts, collars, etc., for all thrust-load fixings in shaft and housing applications. It saves space, weight, assembly time and machining costs. Waldes Truarc presents a significant advance in retaining rings, well worth your thorough investigation. We will gladly furnish samples and full data for tests, upon request.

- **Internal type National Aircraft Standard 50.**
- **External type National Aircraft Standard 51.**

WALDES KOHINOOR, INC. Long Island City 1, N. Y.

Canadian Representatives: Preuco Progress & Engineering Corporation, Ltd., 72-74 Stafford Street, Toronto



THE WET CLOTH *that* WOULDN'T GET LIMP

We have made it and it still looks and feels like cloth; but, actually, every thread is impregnated with a synthetic resin and repels water and many ordinary chemicals. Water will go through it, but not into it. That is *impregnated* cloth.

We make it another way in which the openings between the threads are filled and water will not soak into it or pass through it. That is a *filled* cloth. These are typical of many processes of preparing cloth for special uses — of combining a cloth structure for strength and flexibility with some form of what may be termed a "plastic."

Do not confuse these and other Holliston processes with ordinary cloth finishing. We prepare cloth with special characteristics to meet special needs — functional or decorative. Many of these processes make cloth a "flexible plastic," capable of being folded, creased, stretched, glued or formed.

If you have a material problem for Post War production, consult our Research Department

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Processors of Cloth for Special Purposes

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HOLLISTON special finish cloths meet special needs —

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Cloth combined with special compounds, filled, impregnated, coated — to form a material with characteristics of a plastic and the flexible strength of a woven fabric.

In designing any bearing application you should take advantage of this fact: Bunting Bronze Bearings, today, surpass any Cast Bronze Bearings ever before produced in volume. The Bunting Brass & Bronze Company, Toledo 9, Ohio

Bunting

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

24

FOR REPEATED HIGH STRESSES...

Specify Sier-Bath Gears

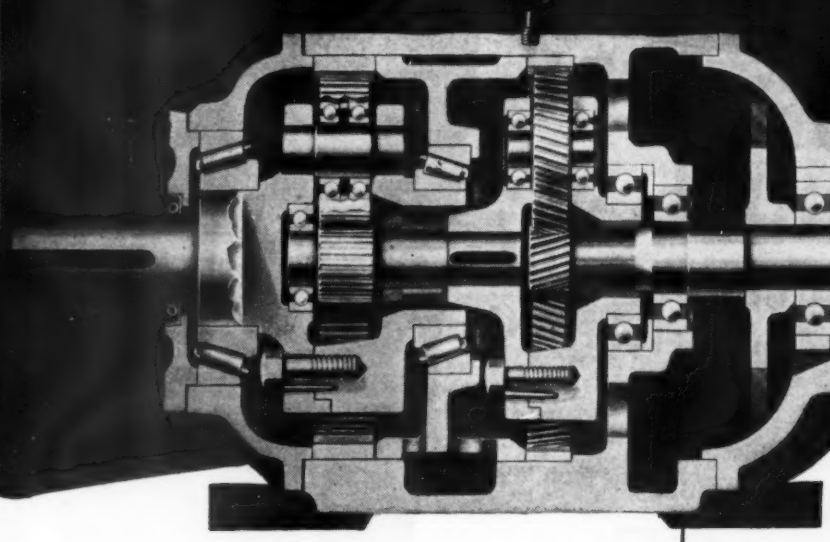
Correct heat-treatment has an important influence on the life of gears subjected to repeated high stresses. Sier-Bath's facilities include one of the most complete and modern heat-treating departments in the country. It is manned by seasoned gear experts, long-term, loyal employees who add personal interest to gear know-how. They have solved some of the knottiest wartime and peacetime gear problems involving severe service. Let them solve yours. Outline it to us today.

☆ 1945 MARKS OUR 40TH YEAR OF SERVICE ☆

Sier-Bath Gear Co. Inc.

SIER-BATH GEAR COMPANY, Inc., 9246 HUDSON BLVD., NORTH BERGEN, N. J.

← a STRAIGHT LINE →



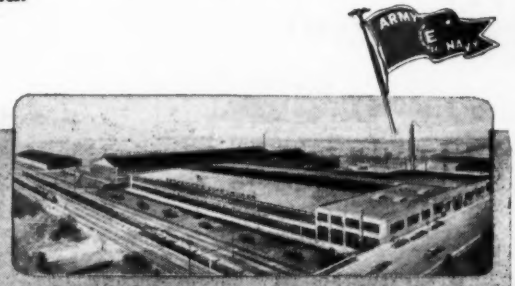
Philadelphia
PLANETARY
Speed Reducer

...the Shortest Distance to Efficiency!

• The straight line or concentric shaft type Philadelphia Planetary Speed Reducer is well suited to drives where space is limited, where a neat appearance is desired, and where a simple baseplate design is preferred. The planetary type gearing is precision made of heat treated steel, and mounted entirely on ball or roller bearings. The sun pinions each mesh with three equally spaced idlers, thus reducing pitch line velocity, noise and wear. The idler gears are supported on both ends rather than being overhung as in some planetary designs.

Gear ratios cover a range of 4:1 to 106:1, with sizes up to 100 horsepower. Efficiencies up to 98% are obtained.

Complete details are covered in our Bulletin 100. Write for a copy on your business letterhead.



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GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

Industrial Gears and Speed Reducers
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Parcell and Bauer's ample facilities, modern equipment and experience assure you of FAST DELIVERY on worm gears and lead screws in large or small runs.

Precision Thread Grinding Equipment that holds rigid tolerances on every piece of stock assures uniform precision products at a price comparable to ordinary in-stock items.

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Speed your jobs by specifying P&B Precision Ground Gears and Screws. Just send a blueprint of the part and the quantity . . . we'll quote quickly.

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Parcell & Bauer PRODUCTS COMPANY

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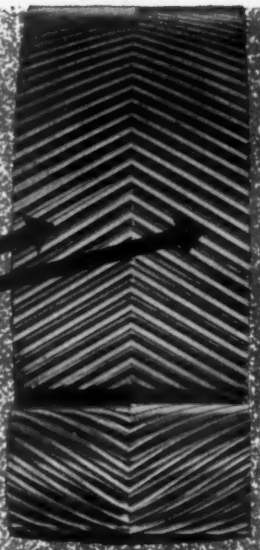
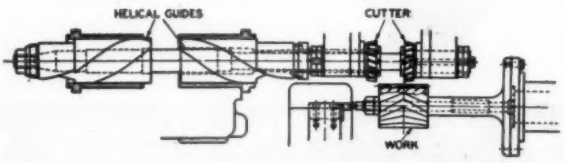
You can cut

BOTH HELICES AT ONCE ON THIS MACHINE



Outstanding among the 18 different types of gears, toothed forms and other parts that can be produced on the Farrel-Sykes Gear Generator is the *continuous tooth* herringbone gear.

On the Farrel-Sykes machine both helices of these gears are precision generated simultaneously, without center groove for tool clearance. Instead the teeth meet in sharp "V's" which give the gear extra strength and load capacity in minimum space.



Set-up for cutting a double helical gear or pinion.

A highly developed, efficient machine tool, built with initial precision of the highest order, the Farrel-Sykes Gear Generator is capable of turning out uniformly precise work for 30,000 hours or more—15 years of normal use. This machine is built to maintain a high operating rate and its efficiency is increased by ease of setup and many automatic features.

It is available in four different sizes for producing gears in various size ranges from 0" to 61" in diameter. Write for complete information.

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Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte

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Farrel-Birmingham

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Does your new product need GEARS?

IF YOUR new or improved products will benefit from better gears, look to Earle! As gear cutting specialists with over 40 years' experience, Earle has the facilities and the "know how" to produce gears that may strengthen the competitive position of your products—as to performance, service and price. Earle manufactures a full range of gear types, cut to specifications, from all practical materials, in sizes from inches to 30 feet in diameter. By sending your specifications to us NOW, your gear needs can be met quicker and better when reconversion starts. The Earle Gear & Machine Co., 4723 Stenton Ave., Philadelphia 44, Pa.

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GEARS TO ORDER

Spiral and helical gears; special couplings, bushings and collars; pins, pulleys and rollers. Made to your specifications—*promptly*.

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Bristol, Tennessee

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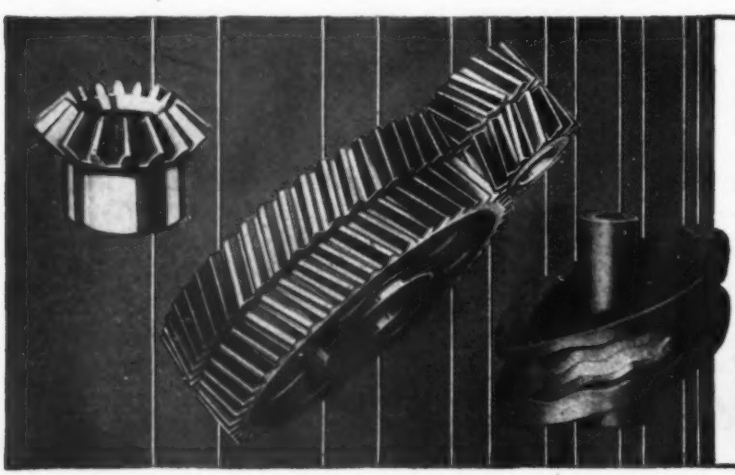
• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the *one* gear suited for your job.

MEISEL PRESS MFG. CO.
946 Dorchester Avenue Boston, Mass.



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AERONAUTICAL PARTS on contract basis

Send blue prints or samples for estimate. Accuracy of work guaranteed to your specifications.

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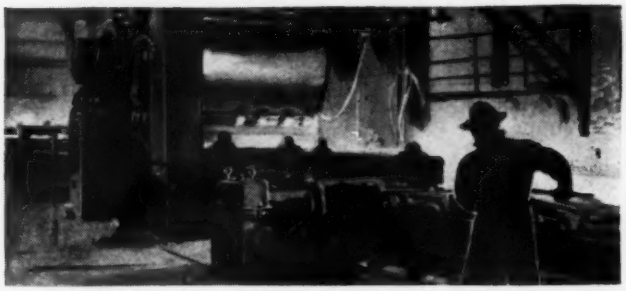
SPECIALISTS IN POWER APPLICATION . . .

AIRCRAFT QUALITY GEARS. The close tolerances to which Foote Bros. Aircraft Quality gears are held—the extreme care with which each step in their production is checked and re-checked—the improved methods of heat treatment—all mean more compact gears that can carry heavier loads at higher speeds.



SPEED REDUCERS. When it comes to speed reducers for any one of a thousand different jobs, you naturally think of Foote Bros. Today—as for the past 86 years—Foote Bros. are producing quality speed reducers in a wide variety of sizes, types and ratios to meet every industrial need.

POWER UNITS. Compact power units are a new development of Foote Bros. engineers. Originally designed for airplanes, many manufacturers in varied fields are considering the application of these units to their machines. They may simplify a problem for you.

• The 89 years of manufacturing experience back of Foote Bros.—the large plant capacity devoted solely to producing power transmission equipment—the staff of skilled engineers whose background includes the solving of almost every type of problem in the field of power transmission—are your assurance that this organization can help you on the machines or equipment you are producing today or planning to produce for the future. Let our Engineering Division work with you on your requirements in power control equipment.

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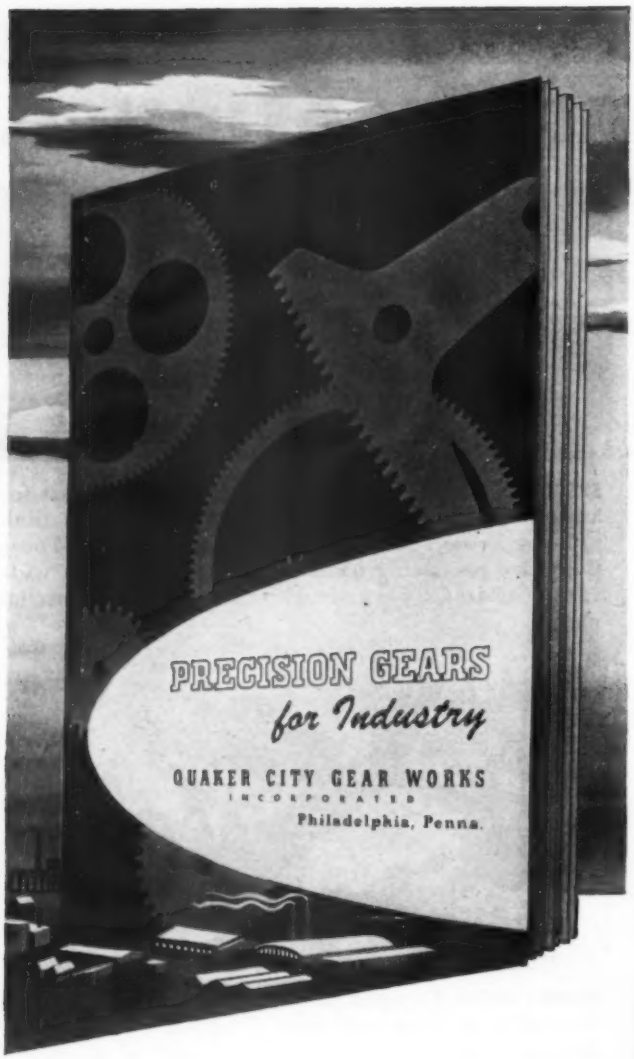
FOOTE BROS.

Better Power Transmission Through Better Gears

This Bulletin giving complete information on "A-Q" gears will be sent on request.



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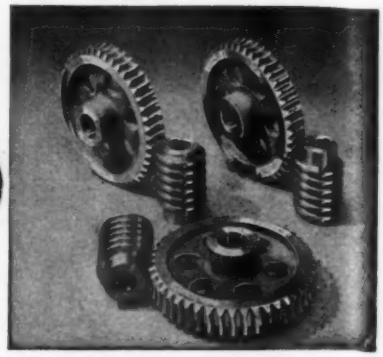
A new informative booklet on gears. It has illustrated sections on practically every known form of gearing, together with many reference tables and formulas. Write for your copy today on your company stationery.

Quaker City Gear Works
INCORPORATED
1910 N. Front Street, Philadelphia 22, Pa.

When the worm turns



let it be STAHL

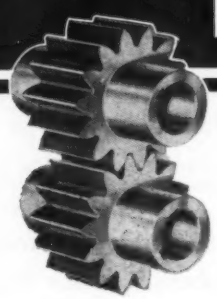
For worms or gears of all kinds —get your estimate from Stahl, because we cut them all—in any quantity—of any material.

With our modern facilities geared to every detail of gear production, we can meet your most exacting specifications — promptly — effectively — economically.

Tell us your needs and ask us to tell you how we can meet them. Our quotations will interest you.

THE STAHL GEAR & MACHINE CO.
3901 Hamilton Ave. Cleveland, Ohio

LET... Cincinnati Gears DO IT!



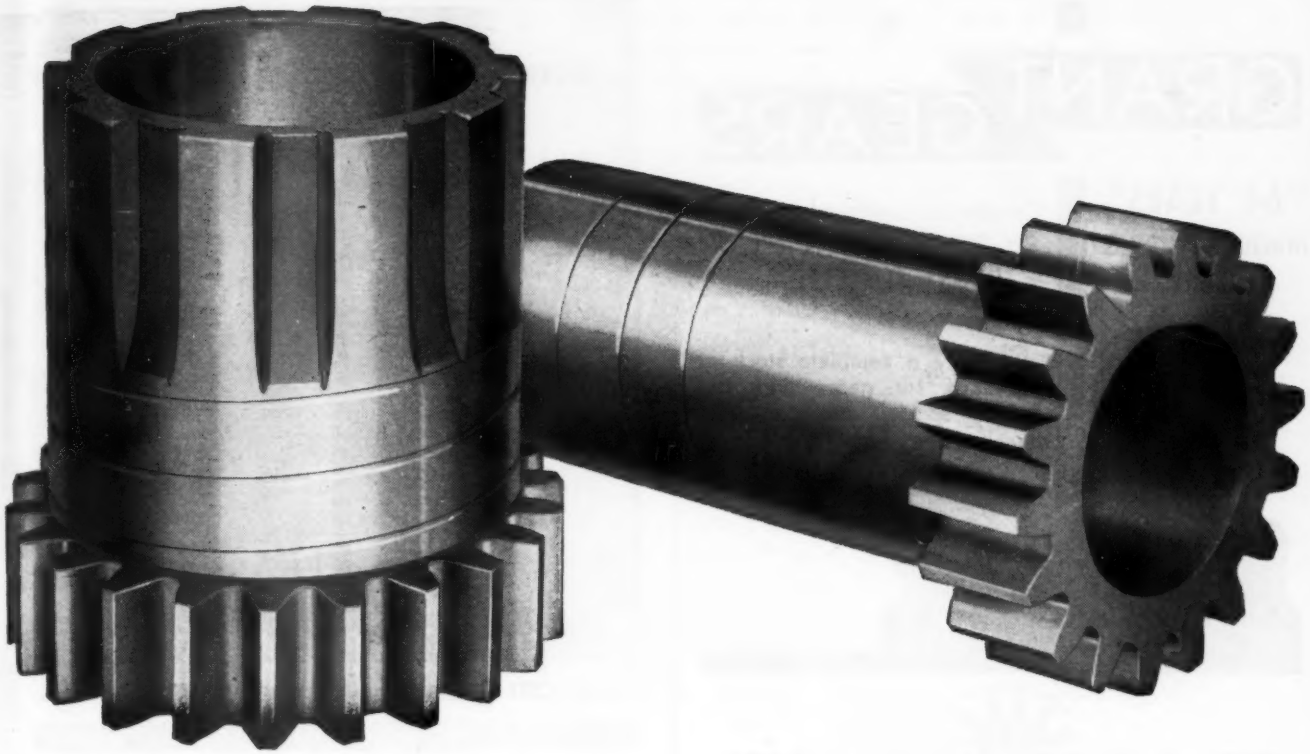
- SPUR
- BEVEL
- HELICAL
- SPLINE
- WORM
- SPECIAL

With our exceptional facilities and skills in gear manufacture we safely extend to you the advantages that go with the use of *Gears, Good Gears Only*.

1 . . . Increased machine efficiency.
2 . . . Faster Production.
3 . . . Product improvement.
4 . . . Longer unit life.
5 . . . Speedier fabrication of units.
6 . . . Lowered costs.

We will appreciate the opportunity of working with you.

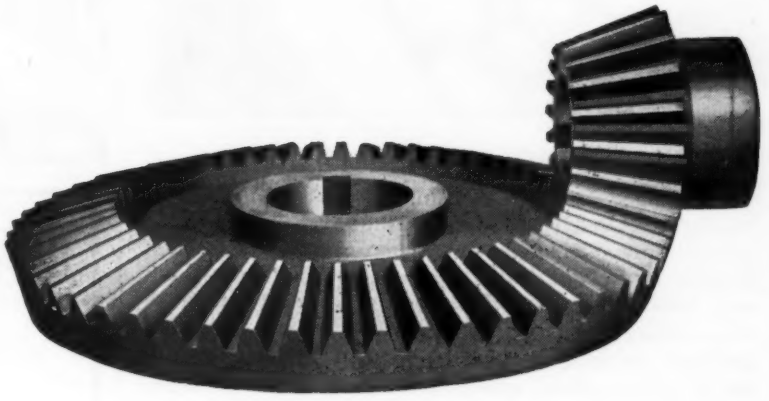
THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. • Cincinnati 27, Ohio



Gears *to your specifications*

Spur Gears
Helical Gears
Splined Shafts
Worms
Worm Gears
Bevel Gears
Miter Gears
Sprockets
Ratchets
Racks
Lead and Feed Screws

Adams Gears are produced with the finest production and inspection equipment obtainable and they can be furnished to your most exacting requirements.



THE ADAMS COMPANY

1942 BRIDGE STREET — DUBUQUE, IOWA, U.S.A.

1883 — Our 62nd Year — 1945

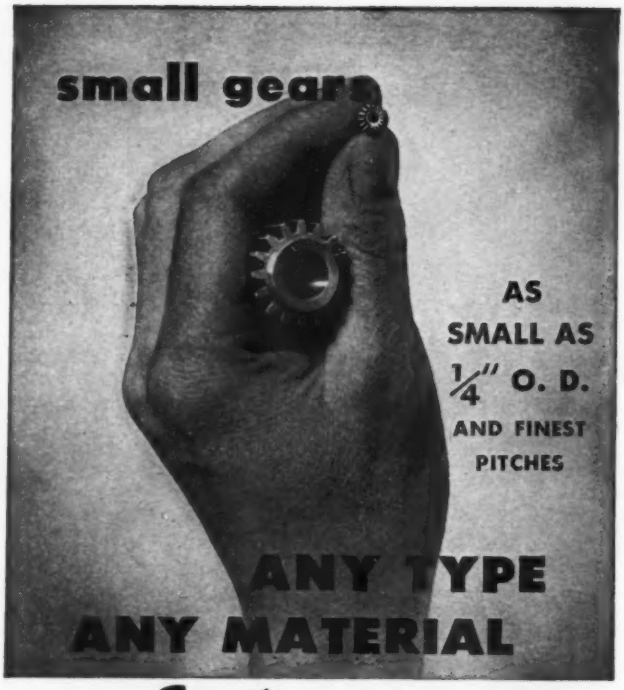
GRANT GEARS

"64 YEARS" MANUFACTURING GEARS

Despite the continued growth of our gear business we are still in position to give each customer the attention they have a right to expect.

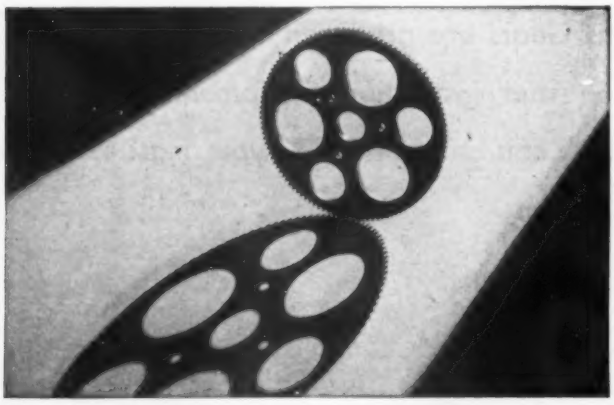
We carry a complete stock of standard cut gears and can furnish special gears to your specifications.

GRANT GEAR WORKS
BOSTON, MASS.
ESTABLISHED 1877 BY GEO. B. GRANT



PRODUCED *Exactly* TO YOUR SPECIFICATIONS

DETROIT *Bevel Gear* COMPANY
8130 JOS. CAMPAU AVE. DETROIT 11, MICHIGAN



COMING EVENTS CAST THEIR SHADOWS—

Greater "know-how" in gear cutting methods has resulted in finer accuracy and finish without additional cost. As a result, gear teeth stand up longer and roll more quietly. These will be important factors in the gear design of your future products, making them more dependable and attractive.

Our services and experience will help you solve production problems on small or medium size spur, helical and rack gears, worms, splines, sprockets and ground threads. Write for quotation on your specifications. No obligation of course.

Beaver Gear Works Inc.
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GANSCHOW GEARS
FOR SIXTY YEARS
Spur—SPEED REDUCERS—Worm
ALL TYPES OF CUT GEARS
GANSCHOW GEAR CO., 18 N. Morgan St., Chicago

BRAWNY GEARS
PROMPT ECONOMICAL SERVICE
ALL TYPES, MATERIALS AND QUANTITIES
Ask for Estimate
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GEAR CUTTING MACHINES
New Design
New Features
New Advantages
NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK 5, NEW JERSEY
FRANK E. EBERHARDT, *President*

DES[illegible]OR

hydraulic control

Hydraulics have proved ability to control machine operations—with pressures in pounds or tons, with high precision and high speeds—

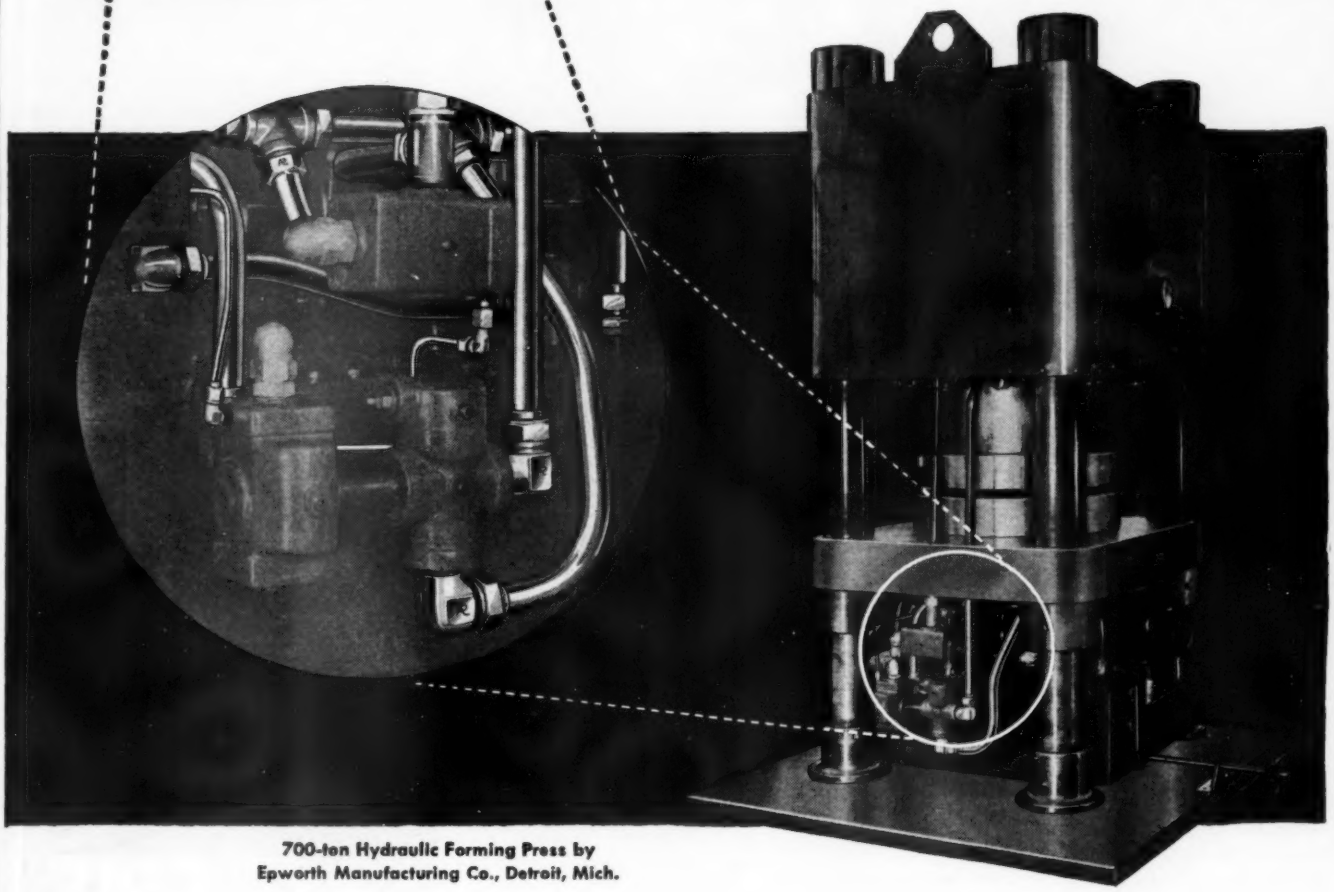
There is only one "if"—the system of tubing, fittings and valves must be properly engineered. Here at Parker we call that job Fluid Power Engineering, and we've been at it for 20 years, on aircraft, motor vehicles, machine tools, refrigeration and process equipment.

A soundly engineered Fluid Power System will have these characteristics:

- It will have streamline flow, to minimize capacity and lessen pressure requirements on the power source.
- It will be compactly designed, to save space.
- All parts will be accessible, for easy and quick service and maintenance.
- It will have the minimum number of joints and connections, to guard against leaks, even under conditions of high pressure, vibration shock, fluid hammer and surge, or accidental abuse.

For the design of such a system, and for the valves, fittings and fabricated parts, or for a simple fluid transmission system, call upon Parker experience.

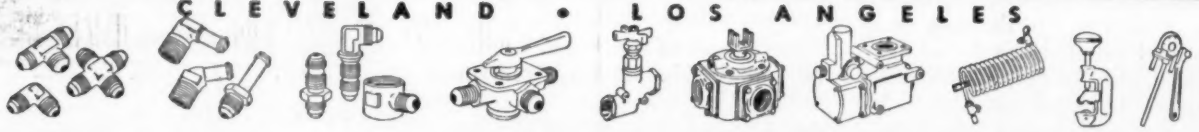
For your present uses, or for new applications to come, talk with a Parker Engineer, especially in the planning stage. You'll save money, and be more certain of satisfactory results. Write to The Parker Appliance Co., 17325 Euclid Avenue, Cleveland 12, Ohio.



700-ton Hydraulic Forming Press by
Epworth Manufacturing Co., Detroit, Mich.

THE PARKER APPLIANCE CO.

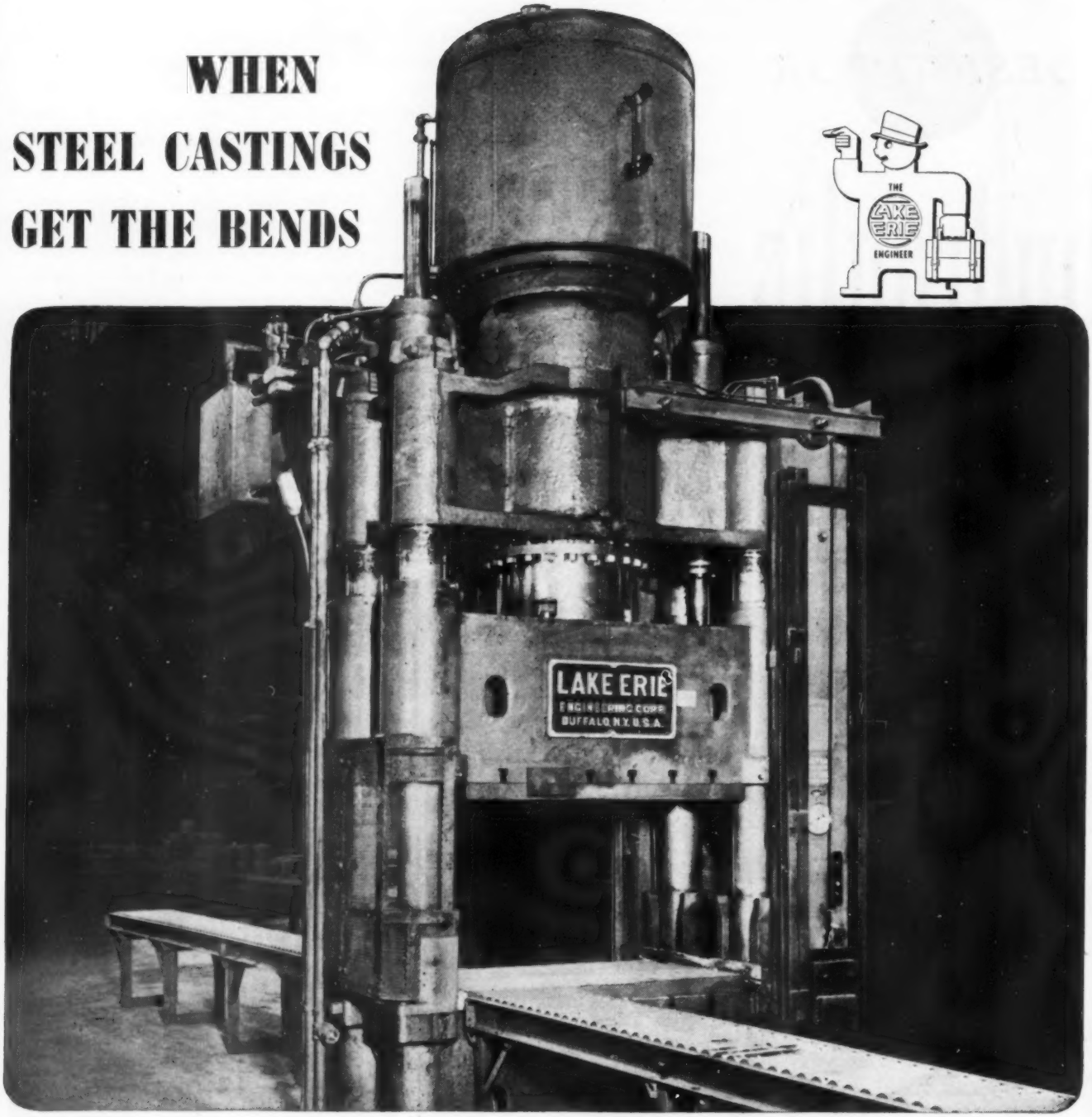
CLEVELAND • LOS ANGELES



FLUID POWER PRODUCTS FOR ALL INDUSTRY

CASE HISTORIES PROVING THE POWER OF THE PRESS

WHEN STEEL CASTINGS GET THE BENDS



This Lake Erie hydraulic straightening press, built for the Pratt and Letchworth Co., Buffalo, is used for straightening castings. Designed by experts and produced by experienced craftsmen, this press has push-button control with adjustable pressure and is designed to do a specific job. It has many outstanding construction and operating features including simplicity of design, eliminating many mechanical parts subject to wear; variable stroke—length of stroke being adjustable to suit work; variable pressures—easily and accurately varied to suit every condition; cannot be overloaded by extra thickness of stock, and other features all resulting in low operating and maintenance costs.

Lake Erie Hydraulic Presses are built in a wide variety of standard sizes and capacities. If we do not have a standard press to suit your needs, specify your requirements and we will build it.

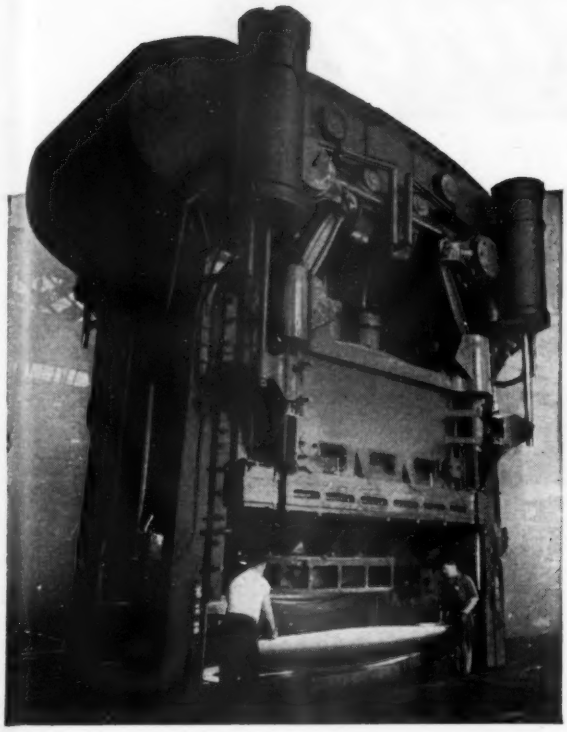
"The Power of the Press" as applied to Lake Erie Hydraulic Presses, means that you can do it better, quicker and more economically.

Write for Bulletin 144—Column Type Presses... Bulletin 244—Side Housing Type Presses... Bulletin 444—Bending, Straightening and Forcing Presses.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

507 Woodward Ave., Buffalo 17, N. Y.

OFFICES IN PRINCIPAL CITIES... UNITED STATES AND FOREIGN COUNTRIES



The HOUSE of SEVEN ABLES

Until the last shot is fired — buy bonds — give blood — salvage fats and paper — work for Victory. Then do your part to ...

1. Able to design for Press Production.
2. Able to Press the Largest Metal Parts.
3. Able to Draw Metal to Deepest Limits.
4. Able to Porcelain Enamel Steel.
5. Able to Bake Enamel Steel.
6. Able to Spot, Seam, or Acetylene Weld.
7. Able to Machine and Finish.

Mullins, "The House of Seven Ables", invites you to take advantage of Mullins design engineering and metal pressing experience. Call for a Mullins Press Engineer.

Manufacturers of
Youngstown Kitchens by Mullins

DESIGN ENGINEERING SERVICE
LARGE PRESSED METAL PARTS
PORCELAIN ENAMEL PRODUCTS

Mullins
MANUFACTURING CORPORATION
SALEM and WARREN, OHIO

Mullins can PRESS it from METAL instead.

Pressing

For Uniform Density in the Compacted Shape

POWDERED METALS

Elmes Model No. 5685 powdered metal press, shown with die for forming long bars. Two slides, one above the work and the other below, can each exert a 1000-ton pressure. This simultaneous movement from both top and bottom assures uniform density in compacted shape because hydraulic equalizing causes slides to travel at a fixed ratio regardless of resistance or pressure. After pressing, mold dies move apart hydraulically to facilitate removal of bar for sintering. Elmes powdered metal presses combine rigidity with power, speed, and accuracy.

Powder metallurgy—the processing of powdered metals into finished parts—points the way to many economies on *many* types of work. Intricate shapes can be formed with remarkable accuracy and finish. Repetitive production speeds output, cuts costs. Alloys can be mixed in any proportions—frequently not otherwise obtainable—for hardness or other use characteristics. Density can be varied, and parts made porous for impregnation. Possibilities challenge the imagination.

Pure powdered metals much finer than flour are measured and mixed thoroughly. This mixture then is pressed into a fragile shape to which subsequent sintering (heating) gives strength. Pressing must be *precise,* for dies may be complicated, and density is determined in this operation.

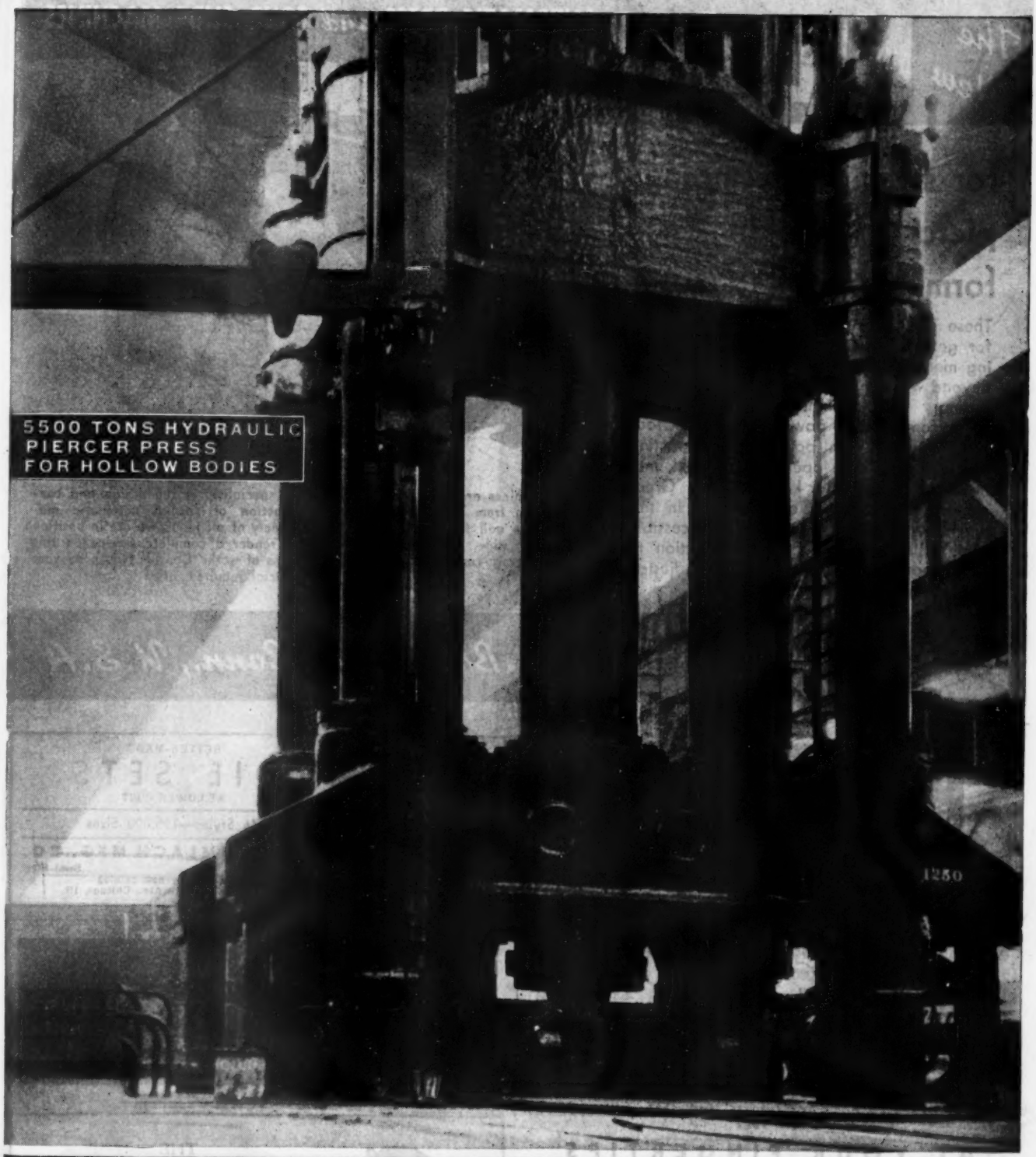
ELMES HYDRAULIC EQUIPMENT

Elmes hydraulic powdered metal presses are *ideal* for such requirements. Force is applied gently, but *surely.* Pressure is *instantly* variable. Quick response to sensitive control permits *precision operation* for uniform density throughout the *entire* run.

From a little-used prewar process, powder metallurgy has grown into a versatile production method destined to exert tremendous influence upon postwar operations. If you contemplate entering this field, or propose to expand your facilities, you are invited to "Put Your Pressing Problems up to Elmes." Nearly a *century* of hydraulic specialization, and distributors from coast to coast, are at your service.

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 1001-1013 W. Fulton St., Chicago 7, Ill.

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES



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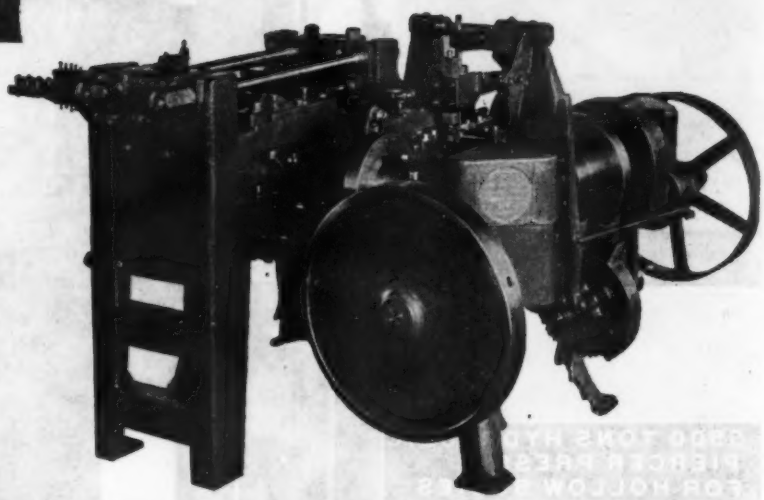
570 LEXINGTON AVENUE · NEW YORK · N Y

The New NILSON AUTOMATIC PRESS and FOUR SLIDE MACHINES

for swaging, stamping, piercing, blanking, forming of coiled metal

These new machines built in two models—for general purpose, heavy duty fabricating metal forming—provides a capacity far beyond what is practical to accomplish with ordinary cam motion. The new NILSON is a combination power press and four slide machine with powerful silent action of main press slide operated by crank motion through toggle or knuckle joints. Great strength and rigidity are inherent in this machine. Die sets are readily accessible and easily removable. No obstruction to view is offered and tools can be adjusted without interference.



These machines are built in 2 sizes—for forming from 3/16" and ¼" diameter wire and for flat material 2" and 2½" wide. Send for 4-page bulletin giving complete details.

As specialists in the design and construction of special automatic machinery of all kinds, we are in position to render a complete service on this class of work. Consult Nilson on your special requirements.

THE A. H. NILSON MACHINE CO...Bridgeport, Conn., U.S.A.

PRODUCTO

ALL-STAR SERVICE

AT YOUR FINGERTIPS

To give you a firm grasp on one of your most important production problems, we operate, in addition to the main plant at Bridgeport, five strategically located Stock and Assembly Plants. All of them stand ready, at a moment's notice, to render speedy service and make prompt shipment of your requirements for Die Sets and Die Makers' Accessories.

Any Producto Plant is as near as your telephone.

THE PRODUCTO MACHINE COMPANY

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NEW YORK, 197 LAFAYETTE STREET

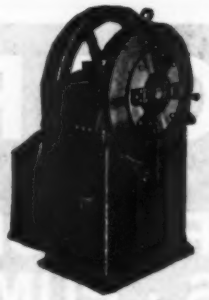
BAUMBACH STANDARDIZED DIE SETS

BETTER-MADE
DIE SETS
AT LOWER COST

46 Styles—195,000 Sizes

E. A. BAUMBACH MFG. CO.
Machined Steel Semi-Steel
Send for our new catalog
1812 South Kilbourn Ave., Chicago, Ill.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
The V & O Press Company, Incorporated
HUDSON, NEW YORK



THE
TORRINGTON
ROTARY
SWAGING MACHINE

— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

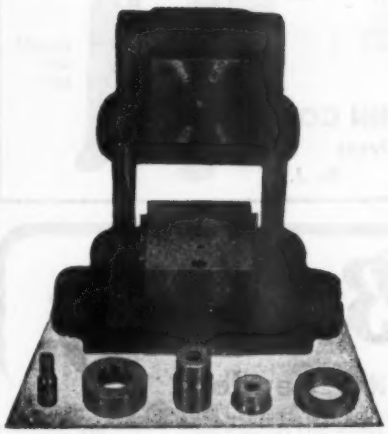
The Torrington Co., Swager Dept.
56 Field Street Torrington, Conn.

WHEREVER WASHERS ARE MADE

HOVIS

UNIVERSAL MASTER WASHER DIES

offer advantages you can't afford to overlook



Made in Five Sizes: ¾" — 1½" — 2½" — 4" — 6"

OUTSTANDING MANUFACTURERS know from experience the saving of time, storage space, material and labor made possible by the Hovis method of making washers. No longer is it necessary to make a complete new die for each new size and type of washer. Instead you make a nominal investment in MASTER WASHER DIES, then 5 small interchangeable parts are the only items necessary to purchase to make any size washer. And the Hovis MASTER WASHER DIES themselves do not become obsolete; they can be used for both present and postwar production.

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HOVIS SCREWLOCK COMPANY

8098 E. NINE-MILE ROAD — Suburb of Detroit — Phone: Centerline 1575 — VAN DYKE, MICHIGAN

FOOT POWERED SHEAR CUTS COSTS

- ✓ SMALL INVESTMENT — First Cost Is Only Cost
- ✓ NO OPERATING EXPENSE — Except for Labor
- ✓ SIMPLE TO INSTALL — Unpack and Start Shearing
- ✓ EASY GAUGE SETTINGS — Simple, Fast and Sure
- ✓ ACCURATE SHEARING — Cross Head Reinforced
- ✓ EFFORTLESS OPERATION — With Balanced Leverage

Famco FOOT POWERED Squaring Shears cut up to 18 gauge mild steel with ease. Made in five sizes . . . 22", 30", 36", 42" and 52" cutting widths (three largest have "hold down" attachment). The knives of all models have tool steel cutting edges. Compression springs are encased against breakage. Furnished with front, side and back gauges. Write today for full information on the Famco line of low cost Squaring Shears.

POWERFUL PRESSES THAT NEED NO POWER

Famco Foot Presses, made in 10 models (bench and floor stand types) are widely popular for light forming and stamping operations.

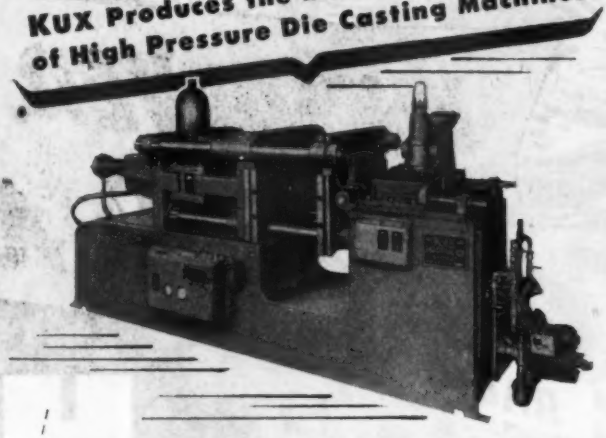
Famco Arbor Presses deliver up to 15 tons pressure without power cost. Make assembly or dismantling easy. 32 models, in bench or floor types.

FAMCO MACHINE COMPANY, 1316 18th STREET, RACINE, WISCONSIN

famco ARBOR PRESSES FOOT PRESSES SQUARING SHEARS

Availability!

KUX Produces the Most Complete Line of High Pressure Die Casting Machines



A size and model for every individual die casting need. 15 different types and sizes. Air operation or self-contained hydraulic operation. Automatic electrically timed casting cycle. Bullet-speed metal injection for densely consolidated castings. Safe, massively strong die plates and toggle mechanism.

WRITE FOR CATALOG OR DEMONSTRATION

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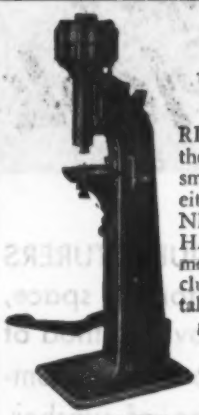
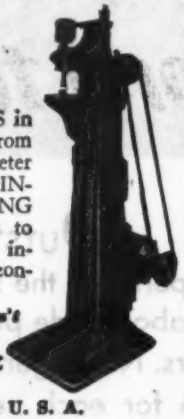
3924-44 West Harrison St.
Chicago 24, Illinois

GRANT



RIVETERS — PIONEERS in their line—head rivets from smallest to 5/8" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.



THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.

STRAIGHT SIDE SINGLE CRANK PRESSES for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

Sturdily constructed with either solid frame or built up with tie rods. Small elastic deflections do not affect tool alignment. All stresses taken centrally. Made also with wedge adjustment for slide for very close work.

Full details on request.

straight side press

ZEH & HAHNEMANN CO.
180 Vanderpool Street
NEWARK N. J.

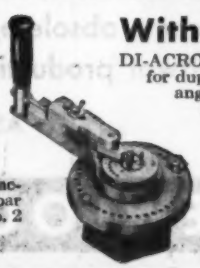
A CENTERED EYE IN 1 OPERATION

DI-ACRO IS PRONOUNCED DIE-AGK-RO

Precision CENTERED EYE *Bending*

The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at high hourly production rates. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

DI-ACRO Bender No. 1
Forming radius 2" approx. Capacity 1/4" round cold rolled steel bar or equivalent. Also Benders No. 2 and 3, with larger capacities.



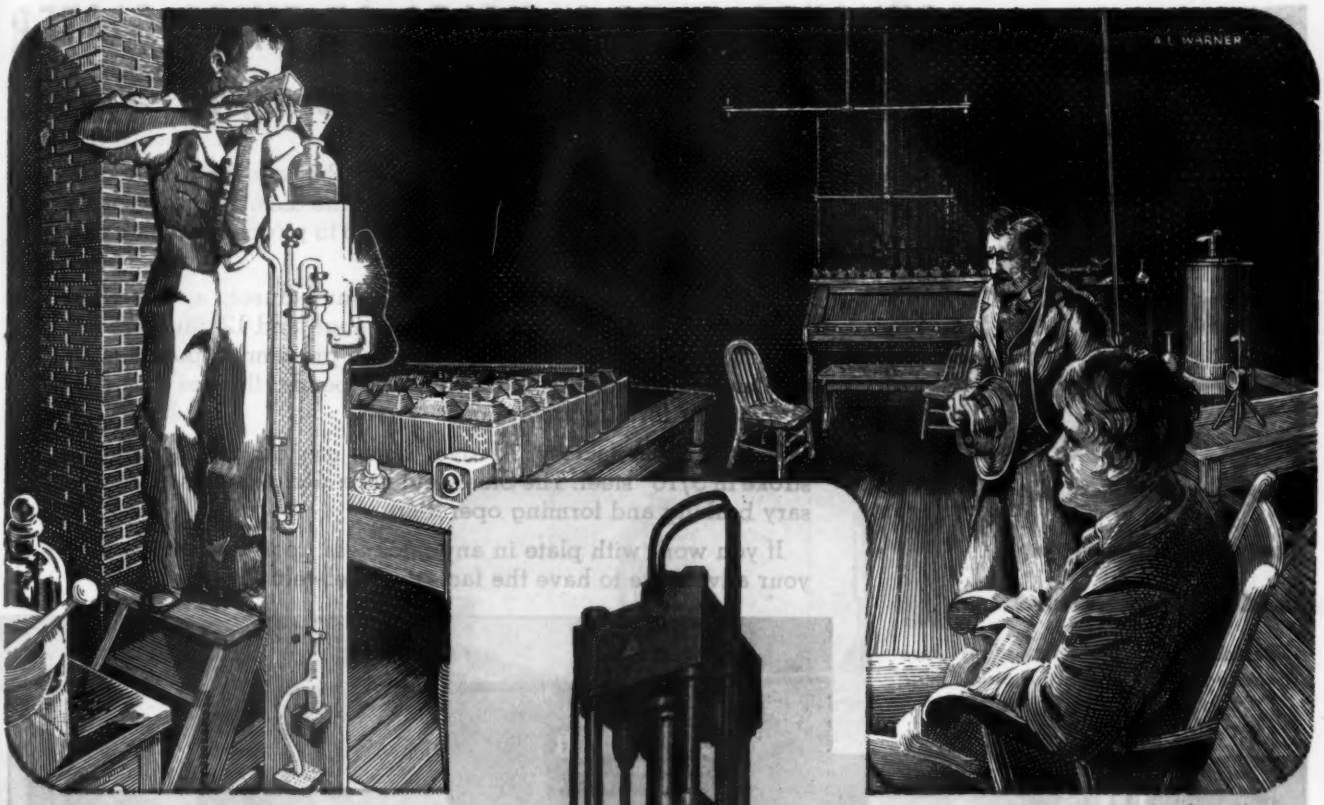
With DI-ACRO Benders

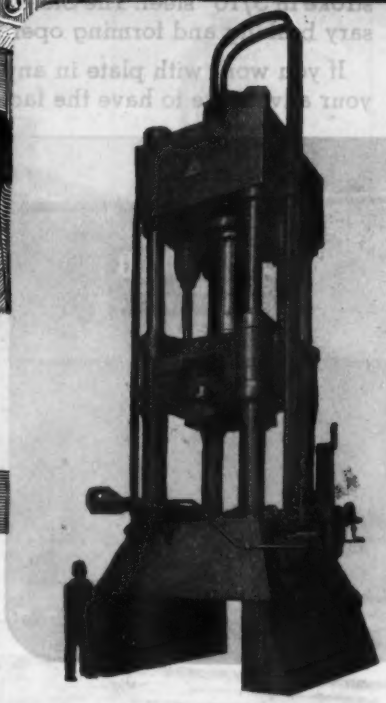
DI-ACRO Precision Bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

Send for CATALOG
"DIE-LESS" DUPLICATING showing many kinds of "Die-less" duplicating produced with DI-ACRO Benders, Brakes and Shears.

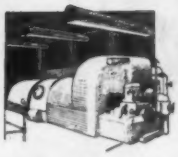
DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO. 311 EIGHTH AVE. SOUTH • MINNEAPOLIS 15, MINN.





WHO INVENTED INCANDESCENT LAMPS?



You'd muff the $64 question if you said that Thomas Edison invented incandescent electric lights. Long before his time, such lamps were dispelling darkness in various parts of the world. Why then do most of us link the idea of electric lighting with Edison's name? Because he combined existing methods, new techniques and his own ideas to give incandescent lighting far greater adaptability, reduce its cost, make it practical.

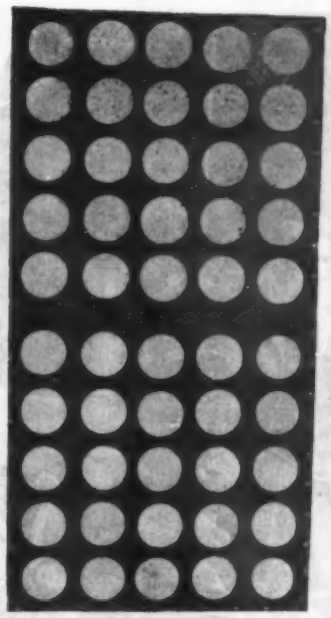
What Edison did in lighting, Clearing has done in the field of forming metal with presses. Many press operations taken for granted nowadays could not be performed before Clearing brought the designing and building of such machines up to date. Today, "Clearing" is synonymous with presses that produce more per hour, that work to closer tolerances on work of ever-increasing size.

It costs nothing to learn how Clearing can help you lower production costs, increase profits with presses to do the "can't-be-done" kind of jobs. Write today for full details.

CLEARING MACHINE CORPORATION
6499 West 65th Street
Chicago 38, Illinois.

CMC CLEARING
MECHANICAL AND HYDRAULIC PRESSES
FOR SUCH OPERATIONS AS DRAWING • BLANKING • FORMING • FORGING

CLEARING ★



PUNCHES 5" TO 8" HOLES 25 TIMES FASTER

Gang-Punches 25 Bolt Holes Per Stroke

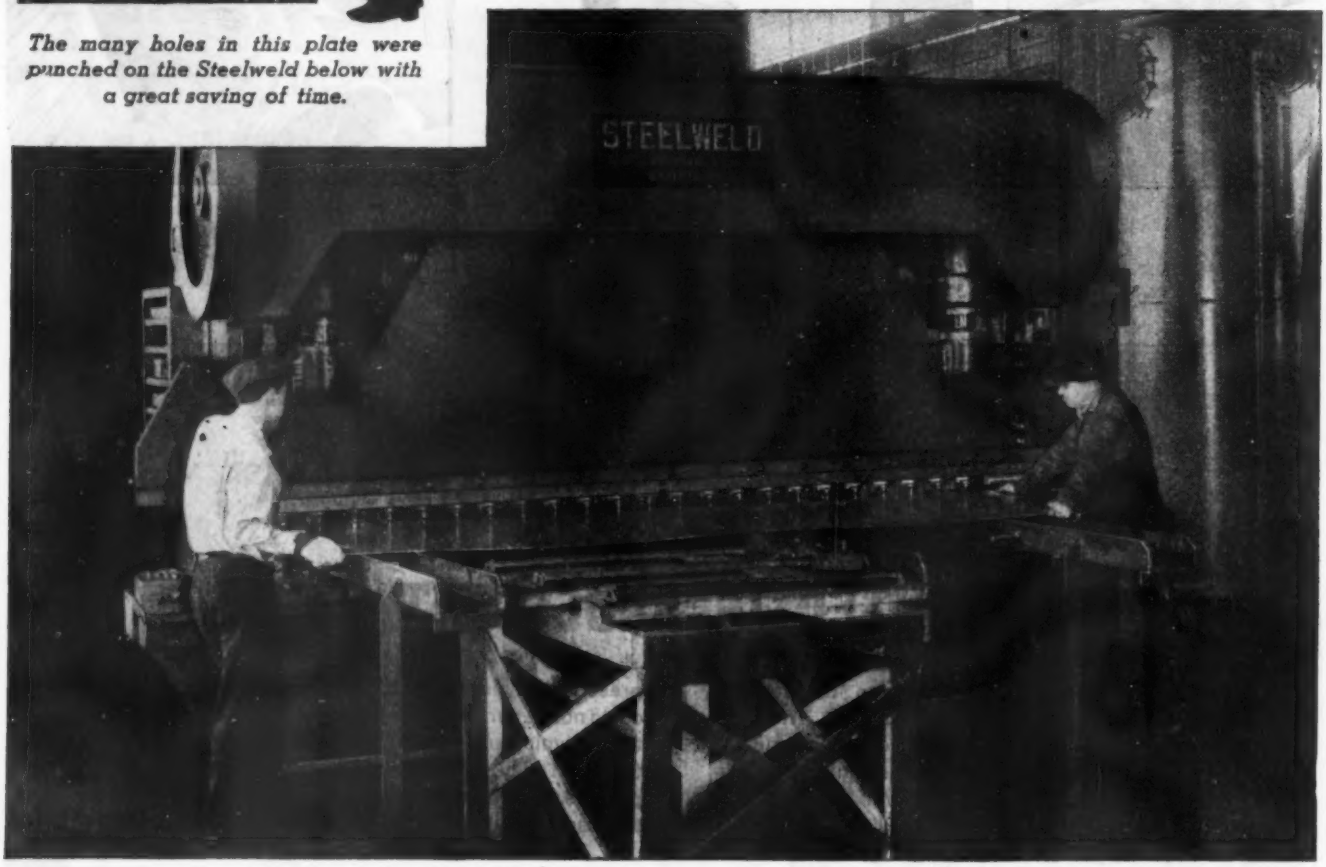
Steelweld Presses are versatile tools that can be adapted to many kinds of work by simply changing the dies. The same press that bends and forms plate can be set up to punch holes in a few minutes.

In the plant of a dust collector manufacturer, a Steelweld punches 5" to 8" holes singly in 10-gauge and 12-gauge plate, 25 times faster than formerly. The same press multi-punches 25 and more bolt holes at a time. It also bends, flanges and performs other forming operations.

In a furnace factory 30 rivet holes are gang-punched per stroke in 3/16" steel. The Steelweld here also performs all necessary braking and forming operations.

If you work with plate in any thickness up to one inch, it's to your advantage to have the facts on Steelweld Presses.

The many holes in this plate were punched on the Steelweld below with a great saving of time.



GET THIS BOOK!

CATALOG No. 2002 gives complete construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

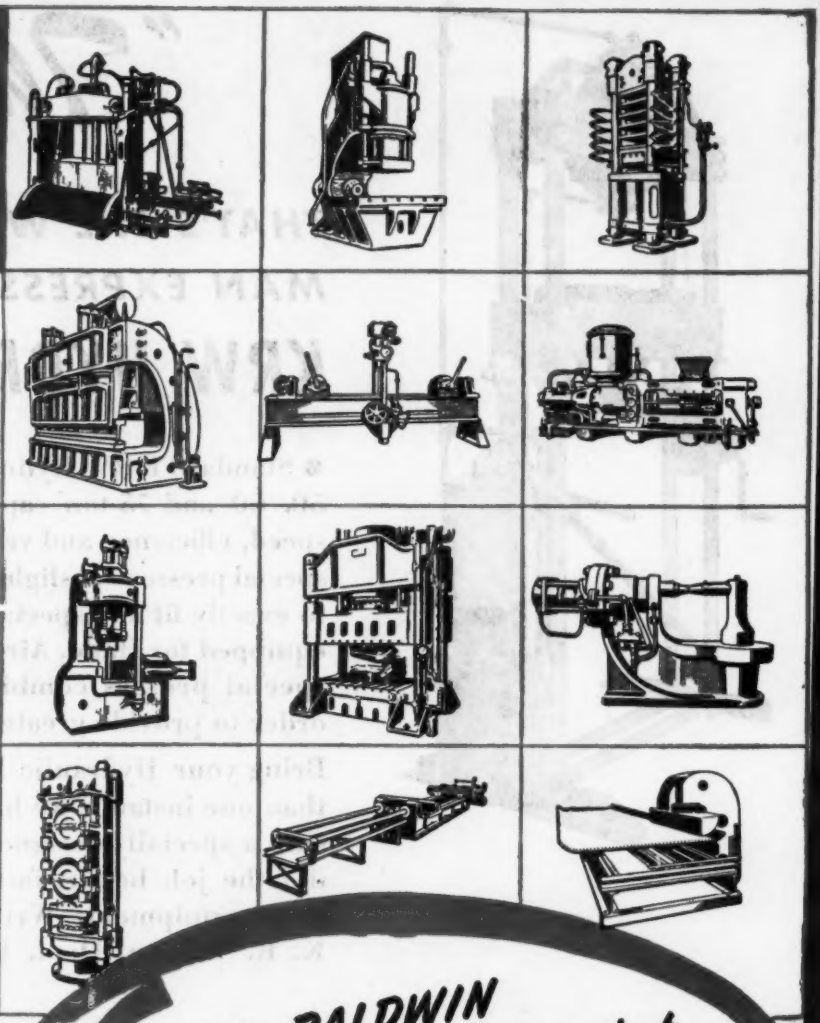
1127 EAST 283RD ST. WICKLIFFE, OHIO.

CLEVELAND

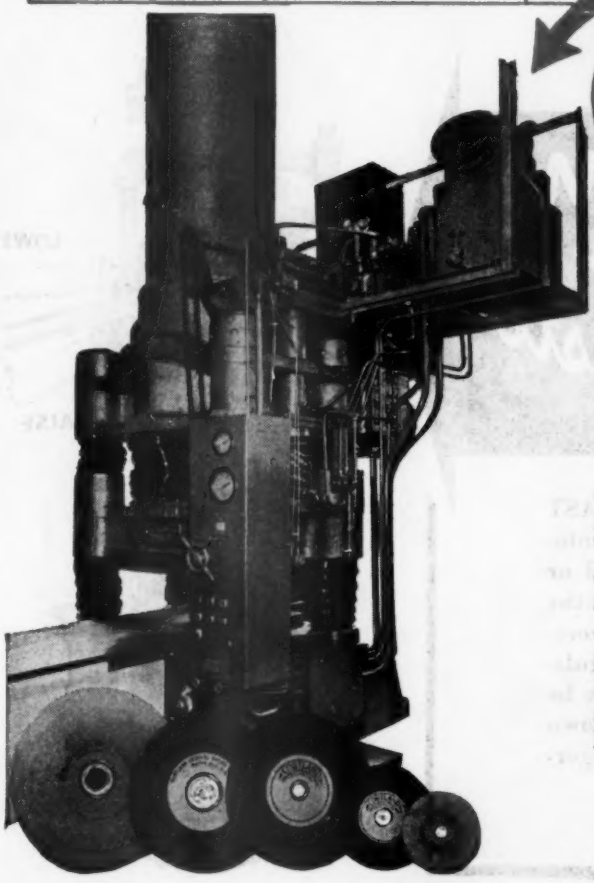
STEELWELD PRESSES

BENDING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

HIGH PRODUCTION HYDRAULIC PRESSES FOR ALL PURPOSES



This BALDWIN SHAPES THE WHEELS that SHAPE THE METAL for you!



The abrasive wheels that you use to remove surface flaws from billets and blooms, or to put a micro-finish on some finished part, were more than likely formed on a Baldwin press.

The illustration shows one such press, built by Baldwin for an important abrasives producer. Using 750 tons of hydraulic pressure, it integrates diamond-hard particles and a binder into a "saw without teeth," that can cut steel as a rat gnaws cheese.

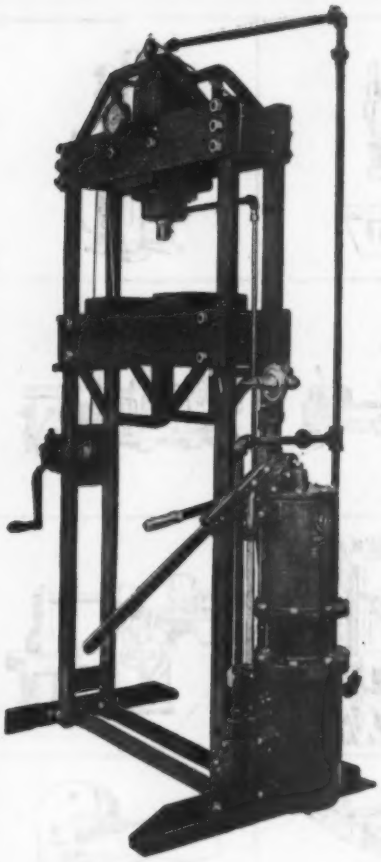
One of the best reasons for coming to Baldwin for your presses is that Baldwin has built practically every kind and variety. What is a brand new problem to you may be an already solved one to our engineers. This eliminates any uncertainty or experiment, assures that the press will do your job right the first time. Ask for Press Bulletin No. 160.

Baldwin Locomotive Works, Baldwin Southwark Division, Phila., Pa., U. S. A. Offices: Philadelphia, New York, Washington, Boston, Chicago, Cleveland, St. Louis, Detroit, San Francisco, Houston, Pittsburgh.

BLW THE BALDWIN GROUP

BALDWIN

HYDRAULIC PRESSES



"They can do

THAT'S THE WAY ONE PRODUCTION MAN EXPRESSES HIS OPINION OF

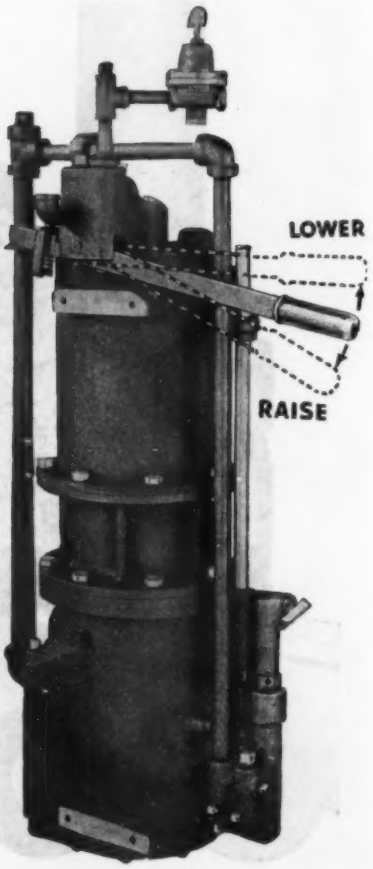
KRW HYDRAULIC PRESSES

● Standard KRW Hydraulic Arbor Presses are made in 25, 50, 60 and 75-ton capacities and provide the utmost in speed, efficiency and versatility. For unusual applications, special presses—at slight additional cost—can be engineered to exactly fit any special problem. Any KRW Press can be equipped for Hand, Air-Oil or Electric-Oil operation. Many special presses combine these methods of operation in order to provide greater efficiency.

Bring your Hydraulic Press problems to KRW. In more than one instance we have been able to design, build and ship a specially-designed press in a matter of weeks that did the job better, faster and cheaper than costly, hard-to-get equipment. Write for descriptive Press Bulletin. K. R. Wilson, Dept. 11, 215 Main St., Buffalo 3, N. Y.

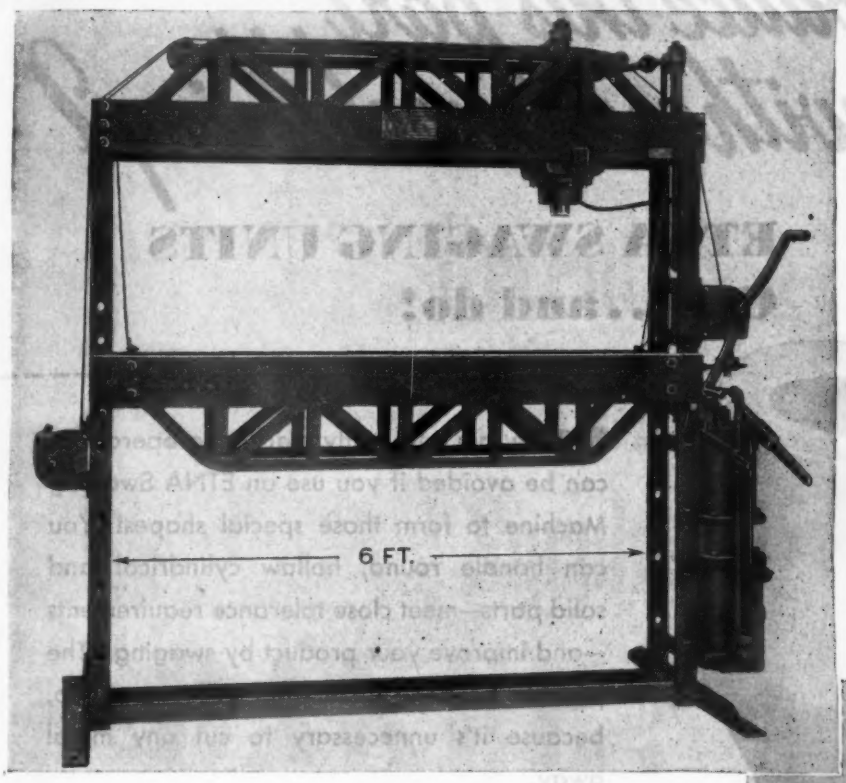
75-ton KRW Press equipped with patented Speedi-Booster and Finger-tip control.

THE KRW Speedi-Booster



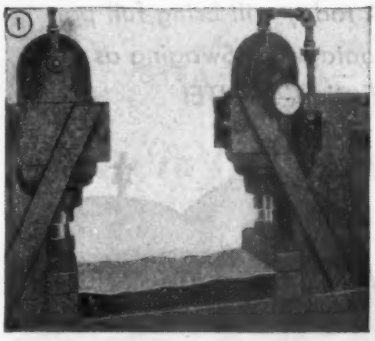
THE REASON WHY KRW PRESSES ARE FAST AND ACCURATE. The KRW Speedi-Booster eliminates the need for the conventional Capstan wheel or pumping lever. Instead, it uses compressed air as the motive power operating the ram. Because the compressed air is controllable through a pressure regulator, any desired tonnage pressure at the ram can be obtained and duplicated. Ram movement (up, down or stop) is instantly controlled with the slightest finger-tip movement of the lever.

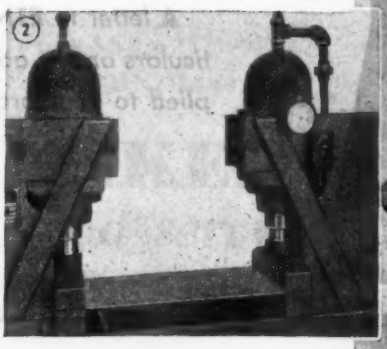
everything but cook"



This special adaptation was built to STRAIGHTEN ARMOR PLATE. The entire ram head mechanism slides the full width of the head frame so ram can be positioned over a "high spot" on the plate. Distance between uprights, 6 feet. Air-Oil and Hand operated.

Adapted as a SHEET METAL STRAIGHTENER. This unit consists of three heads on a special frame. The two upright heads grip the metal sheet. Horizontal head quickly removes kinks by stretching. This unit combines Hand, Air and Electric-Oil operation. (Any one can be used independently).





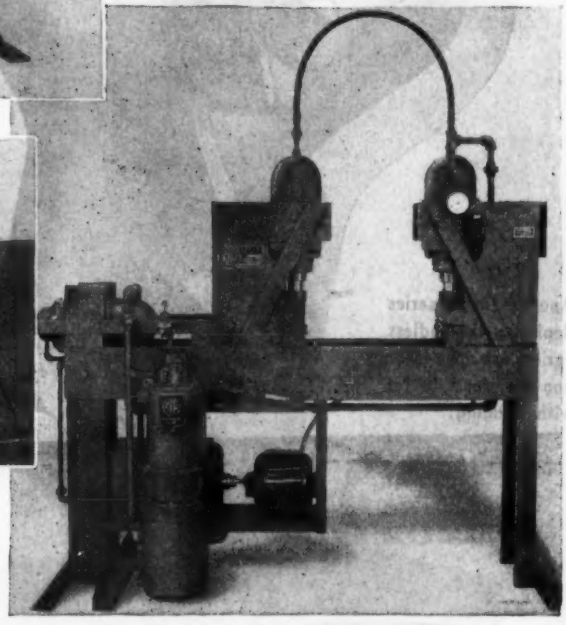


Illustration No. 1 shows "kinked" sheet metal as it comes from the rollers, gripped by the two vertical heads. Illustration No. 2 shows the sheet after being "stretched" flat by pulling pressure of the horizontal head.

AVAILABLE TONNAGE PRESSURES
25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

AIR PRESSURE	9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder
	25 to 51 Tons	33 to 68 Tons

Write Today for the
KRW HYDRAULIC PRESS CATALOG

K. R. WILSON
BUFFALO 3, NEW YORK

Can you produce this part... without machining?

ETNA SWAGING UNITS Can... and do!

Another in a series depicting the endless variety of jobs that can be done better with Swaging!

● Time loss and costly machining operations can be avoided if you use an ETNA Swaging Machine to form those special shapes! You can handle round, hollow cylindrical and solid parts—meet close tolerance requirements—and improve your product by swaging. The job can be done faster and at less cost too, because it's unnecessary to cut any metal away.

A letter to ETNA today will bring full particulars on the advantages of Swaging as applied to your production. WRITE!

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The ETNA Machine Co.

3400 MAPLEWOOD AVENUE

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ETNA Swaging Machines are built in standard sizes with maximum capacities from ⅜" to 6"—die lengths up to 18". Larger sizes up to 14" diameter built on order.

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Current models are 150—217—422
314A—26HO—36HO—30HO Inverted

Here, a BAKER 150 Universal Quick Change Type Geared-feed heavy duty Drill, being used in the production of aircraft engine parts . . . handling the job with an efficiency typical of every machine BAKER has manufactured. And, as is the case with all BAKER Machines, this unit can be retooled quickly and economically to handle a variety of other jobs as conditions require.

. . . then here is BAKER's *plan to assure good service!*

• If you are contemplating the purchase of a surplus BAKER Single or Multiple Spindle Drilling Machines, built 1940-45, check with a Baker representative at the time of your purchase. He will be glad to furnish the date of original purchase, the correct model designation, and information as to the equipment originally included with the machine. In addition, we will cooperate to the fullest extent on any problems of reconversion, directing our efforts and engineering facilities toward gaining for you the finest possible service from whatever BAKER Machine you purchase. Check the list of BAKER Representatives shown here and contact the one nearest you. He'll welcome the opportunity to be of service to you.

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J. F. Dohan, New Orleans, La.
George Keller Machy. Co., Buffalo, New York
Machinery Sales Co., Los Angeles & San Francisco, Cal.
Marshall & Huschart Machy. Co., Chicago, Ill.
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McVoy-Hausman Company, Birmingham, Alabama
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Single and Multiple Spindle Machines for Drilling, Boring and Tapping

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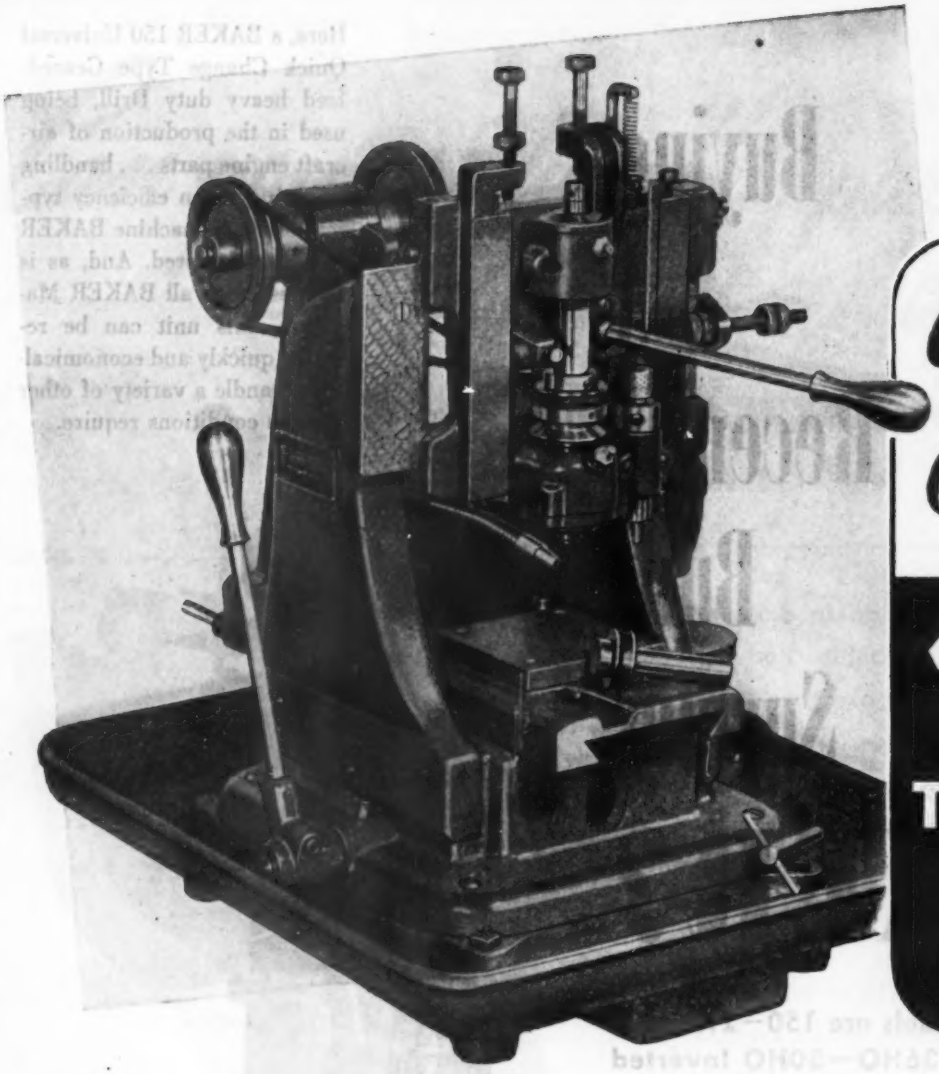

You Save 4 Ways With THIS WADE BENCH PROFILER

When you use the Wade Motor Driven Bench Profiler you save four ways. (1) You save time and (2) you save money. (3) You save work and (4) you save valuable space. You save time and money because this speedy, versatile little machine enables you to produce small precision parts quickly . . . and with greater accuracy. You save money because it increases the unit output per man hour and reduces spoilage to a minimum. Larger machines can be freed for jobs involving more work. And you save valuable space for this compact bench model measures only 19″ x 24″ x 22″ high. With the Wade Bench Profiler you can do profiling, milling, slotting, recessing and routing operations more efficiently and at a lower cost. This time-saving, money-saving machine will handle a wide variety of small parts. It is simply designed so that unskilled help can quickly become expert in its operation . . . so that new operators can immediately start producing accurate parts in money-saving time for you.

Wade

Bench Lathes and Profilers For Precision, Versatility And Stamina

Get complete details of this money-saving profiler. Write today for bulletin.

THE WADE TOOL COMPANY

53 RIVER STREET • WALTHAM 54, MASS.

GORTON

SPECIALISTS FOR OVER 40 YEARS IN

Tracer-Controlled MILLING

PROFILING *TWO* ORIFICES

Of IRREGULAR SHAPE
In TUBULAR PIECE
From **ONE** FLAT MASTER

SIX Operations Completed on ONE Machine in 40 Min.,* Floor to Floor

Gorton Tracer-Control Duplicating provides a simple, fast and accurate means for machining irregular shapes in parts like this Bronze Recoil sleeve shown above. Specifications for this job called for an orifice on opposite sides of the sleeve.

Both orifices required a rough, semi-finish and finish cut—the latter with a 1/4" diameter end mill to produce 1/8" radii at the two corners. Only one set-up is necessary to complete the six operations (3 cuts around each of two orifices) accomplished with a high degree of uniform accuracy, in 40 minutes, floor-to-floor time.*

The simplicity of Tracer-Controlled operation permits even the most difficult work to be accomplished by inexperienced help.

*NOTE—Time greatly reduced in other plants by using a battery of six or more Gorton Duplicators in multiples of three (1 for each cut) eliminating ALL cutter changes.

JOB IN BRIEF

6 Operations—Rough, Semi-finish and Finish Milling of *TWO* irregular shaped orifices in sleeve.

Material—Bronze.

Cutters—(only 3 needed)—Four-flute, fast spiral end mill, 7/16" diameter, two End Mills, 3/8" and 1/4" diameter.

Speed—1900 r.p.m.

Feed—Manual.

Production—40 minutes per sleeve.

GORTON FREE ENGINEERING SERVICE

You are invited to consult Gorton engineers on any jobs applicable to Gorton equipment. Please submit details of your job to your nearest Gorton Dealer or Factory at Racine, Wisconsin. Recommendations made without charge or obligation.

The *Right* Size The *Right* Type of Machine for Every Job . . .
From 2 oz. to 2 Tons

DIE BLOCKS

Tracer-Controlled MILLING

Tracer-Controlled DUPLICATING

Tracer-Controlled ENGRAVING

Tracer-Controlled ETCHING

GORTON *Precision* MACHINES

CUTTER GRINDERS
ETCHING MACHINES
2 & 3 Dimensional PANTOGRAPHS
Vertical & Universal Head Super-Speed MILLERS
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MATTISON
ABRASIVE BELT GRINDING AND POLISHING MACHINES

Mattison W-455 Wide Belt Grinding and Polishing Machine for finishing of wide stainless steel sheets.

Mattison S-441 Grinding and Polishing Machine for flat and curved work. Can be furnished with or without special fixtures, depending on work ground. ➡

Mattison J-400 Backstand Idler adapts regular polishing Jack to the use of factory-coated abrasive belts.

Mattison H-424 Internal Tube Grinding and Polishing Machine for finishing inside of metal tubes.

Mattison L-138 Grinding and Polishing Machine arranged for wet grinding.

★ Results obtained in a number of plants definitely establish the use of factory coated abrasive belts as a most efficient practice. Besides reducing the number of rejections and improving the finish, they have cut the polishing cost per piece through increased production.

However, to secure full benefit from factory-coated abrasive belts, the right type of mechanical unit is necessary. The machine is all important for properly applying the abrasive to the particular job to be done.

Mattison Abrasive Belt Grinding and Polishing Machines are engineered with a knowledge of the factors involved to give the best application of belts. From the time factory-coated abrasive belts were introduced for metal grinding and polishing, Mattison's have developed and built machines to provide best results.

Mattison Abrasive Belt Grinding and Polishing Machines are used for smoothing up welding marks, polishing solid parts—such as handwheels, levers, handles, steel sheets including stainless steel—and the inside of tubes. They are built for both the wet and dry grinding method. In addition to the finishing of metal parts, they are used for plastics, hardened rubber, fibre, glass, etc. In fact, the applications are so numerous, only a few can be mentioned and shown on this page.

MATTISON GRINDING MACHINERY

Whatever your problems may be, it is well worth while to make an investigation as to the machine available for handling it.

SEND FOR *FREE* BOOKLET

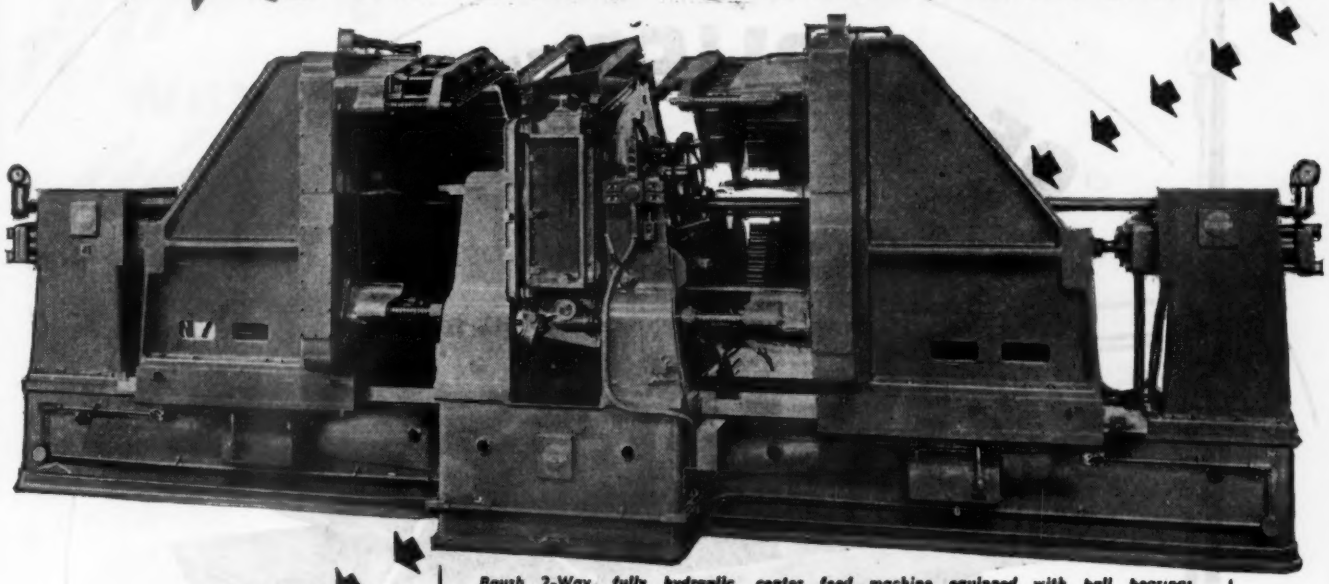
Illustrates various applications of Mattison Grinding and Polishing Machines, built to secure best results from factory-coated abrasive belts. Also gives helpful data on grinding and polishing metals, plastics and other materials with abrasive belts. Write today for your copy.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

Here's How To . . .

Roll 'em Out Faster



Baush 2-Way, fully hydraulic, center feed machine equipped with ball bearings throughout, has 5 station trunnion fixture hydraulically indexed, electrically interlocked with single push-button control. Used to finish from the rough all valve and tappet holes, as well as core drilling the throat and 4 water holes in 6-cylinder block. Left Head has 40 spindles—Right Head 48 spindles. Drilling radius 30" with tie bars assuring greater accuracy of head and fixture alignment.

"Says Stop-Watch Pete of BAUSH" . . . . . .

Limited production of civilian automobiles recently authorized is the forerunner of all-out competition in automobile building.

Are YOU ready for it? Is your equipment modern and in condition to meet the tremendous demand of putting cars on the market quickly and economically?

This Baush 2-Way Hydraulic Multiple Spindle combination, now being used by a leading automobile manufacturer, is just one of the many TIME-SAVING units that makes Baush Machine Tools leaders in the automotive production field.

Let your drilling, tapping, reaming or boring problems be our problems—our Experienced Engineers are ready to go over them with you NOW. A wire, 'phone call or letter from you is all that is needed to bring constructive suggestions and help.

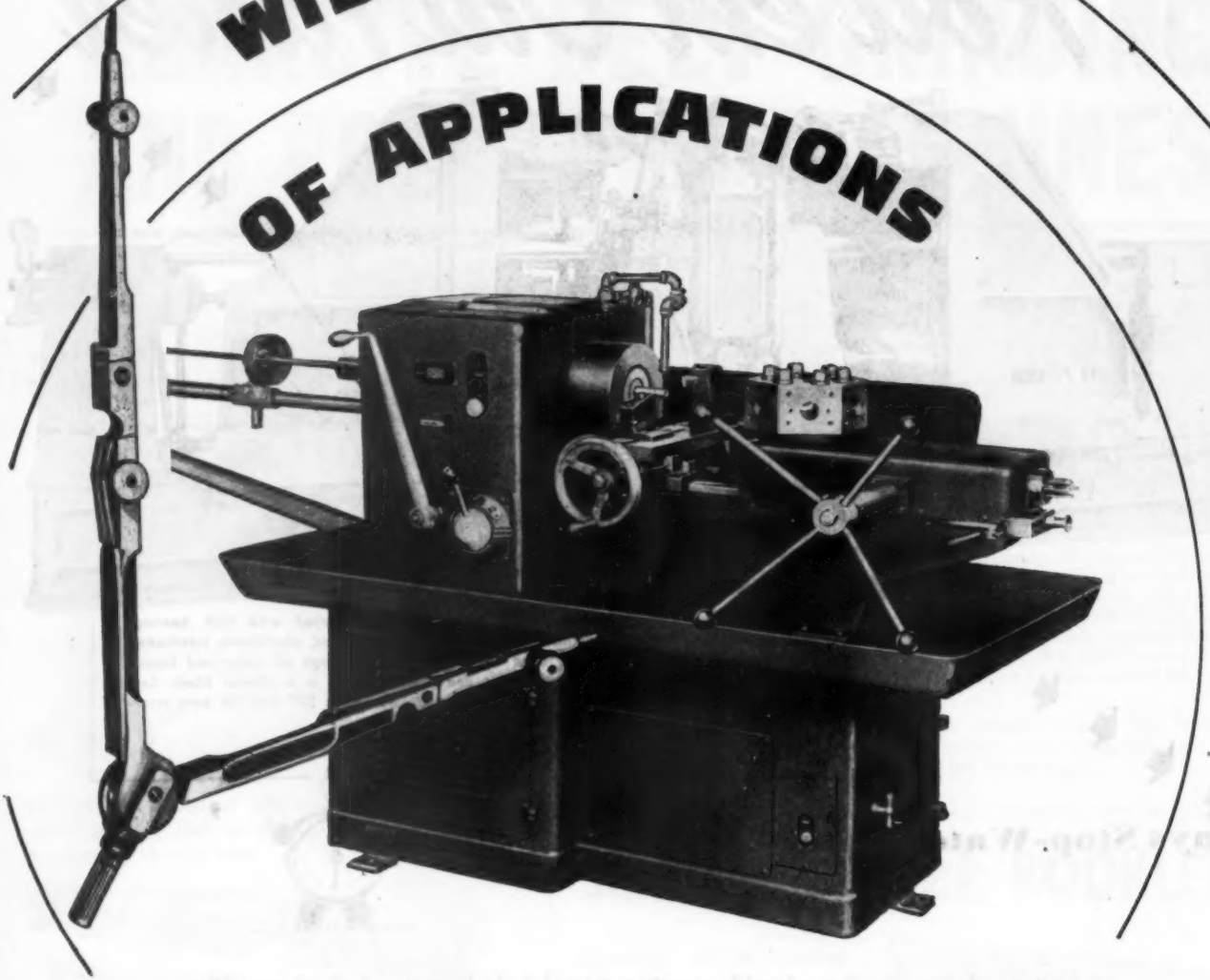
Descriptive circulars upon request.

BAUSH

MACHINE TOOL CO.

SPRINGFIELD 3, MASSACHUSETTS

WIDER CIRCLE OF APPLICATIONS



Widely used in vital war production plants as a *SIMPLIFIED* lathe on numerous bar and chucking operations, the Oster No. 601 "RAPIDUCTION" is now developed to include a still wider circle of applications. Among these recent developments are the following:

1. New 4-speed motor permits four speed changes without change of sheaves. (2-speed motor optional.)
2. Motor is mounted on oil-resistant rubber to insure smooth, quiet operation.
3. Individual ⅛ H. P. motor now operates coolant pump to provide uniform flow of lubricant, independent of spindle speeds.
4. New electrical controls have speed selector switch located conveniently for the operator.
5. Increased rigidity of the machine is insured with longer base of heavier construction.

More than ever, the Oster No. 601 "RAPIDUCTION" lathe offers you "custom-built value" at an economical price. Optional WORM drive or DIRECT drive, as required. Six position turret is automatically indexed. Automatic chuck capacity 1½" round bar.

Inquiries are invited but deliveries are uncertain due to conditions beyond our control.

OSTER

"Rapiduction" LATHES

THE OSTER MANUFACTURING COMPANY • 2049 EAST 61ST STREET, CLEVELAND 3, OHIO, U. S. A.

A Handful of Reasons

WHY Wells No. 8 IS A WISE INVESTMENT

VERSATILE

The Wells will cut most any shape, size or type metal you can get into it. It will take overall sizes up to 8" x 16" rectangles and 8" rounds, solid stock, tubing or structural steel.

PORTABLE

Because the Wells is portable you can move the saw to the work and save time and labor in so doing.

EASY TO OPERATE

Gravity feed and automatic shut-off enables one man to operate two or more Wells Saws. Even an inexperienced operator can do a lot of work with this simple handy tool.

ECONOMICAL

Low in first cost, uses little power, requires little maintenance. Saves money, time, labor, steps up production.

DURABLE

Ruggedly constructed of quality materials, with a minimum of moving parts, the Wells will deliver years of faithful, efficient metal cutting.

SPECIFICATIONS

CAPACITY:
Rectangular . . 8" x 16"
(Special Guides) 5" x 24"

ROUNDS: . 8" diameter

MOTOR:
½ H. P., A. C. or D. C.

SPEEDS: Selective 60, 90, 130 feet per minute

WEIGHT:
Approximately 750 lbs.

Wells SAWS
THE SIGN OF SERVICE

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
505 ROOSEVELT ROAD, THREE RIVERS, MICHIGAN

Start Right

IN RECONVERSION!

Change-over time is the ideal house-cleaning time to get rid of worn-out, inadequate or make-shift machines! In swinging into production on new civilian products . . . *start right* with the *accuracy* and *cost-cutting dependability* of Kent-Owens Milling Machines!

These are the machines preferred by shop men for speedy, practical and efficient production. Rugged . . . simple . . . adaptable to a wide range of work for the job ahead in reconversion. Write for latest bulletins.

Kent-Owens Machine Company, Toledo, Ohio.

No. 1-14 . . . 32" x 9" table . . . 14" table travel.

Specify KENT-OWENS Milling Machines

No. 1-V . . . Hydraulic vertical head feed . . . 5½" head travel . . . 25" x 9" table.

No. 1-S . . . 8" table travel . . . 25" x 9" table . . . full automatic hydraulic table feed.

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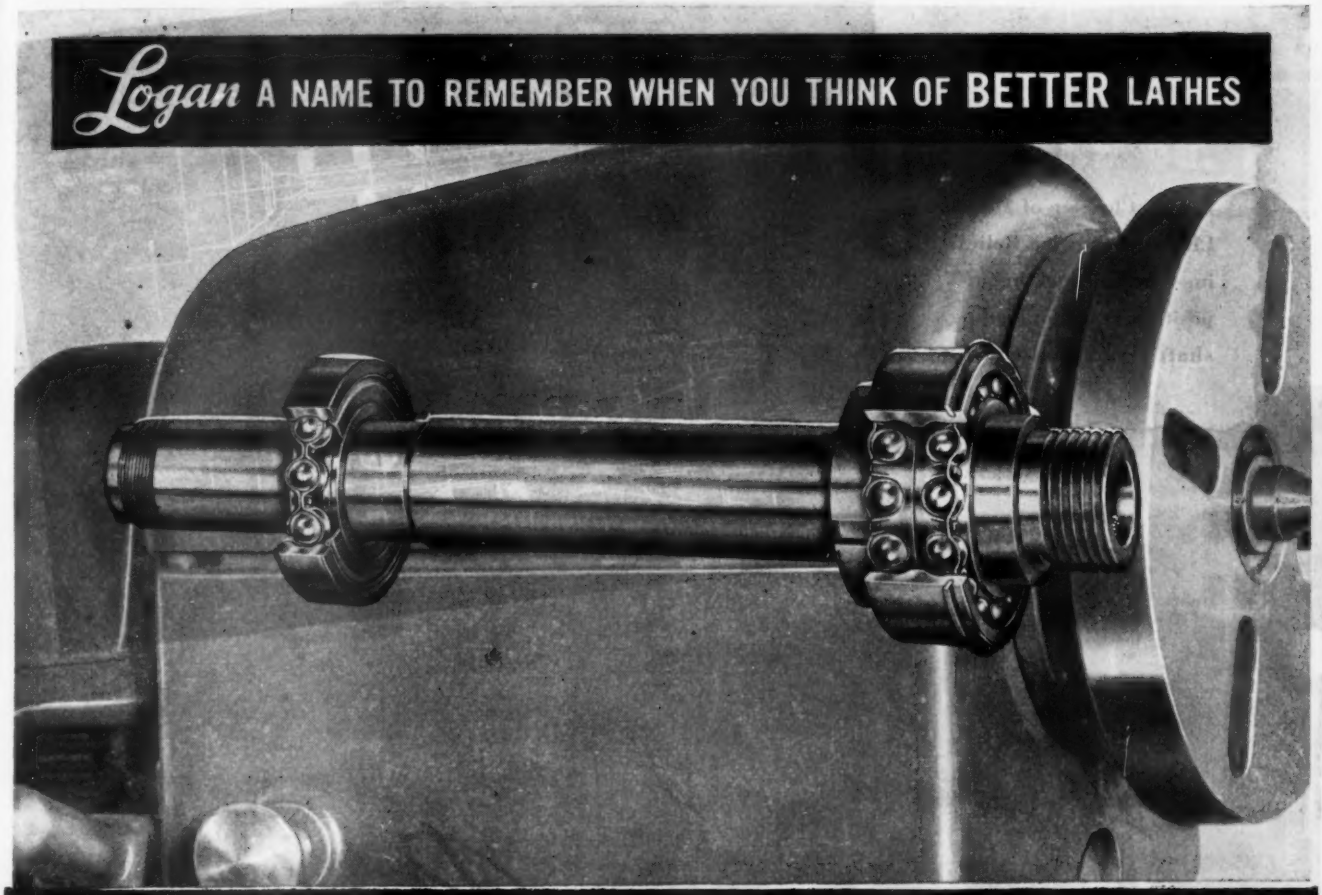
Logan A NAME TO REMEMBER WHEN YOU THINK OF **BETTER** LATHES



Higher Cutting Speeds Without Bearing Adjustment on *Logan* LATHES

No. 200
Screw Cutting
Lathe

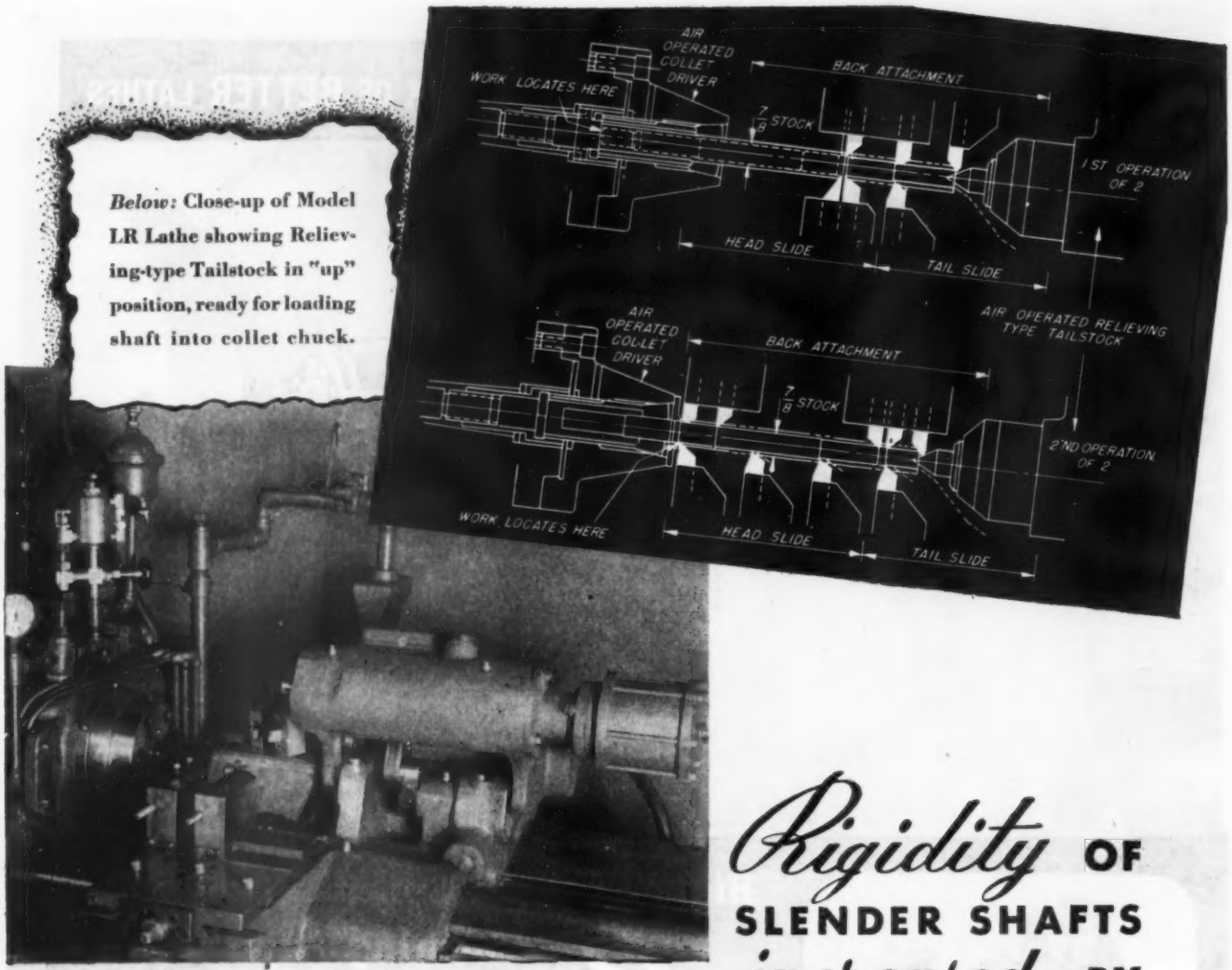
No. 825 Cabinet Model
Quick Change Gear Lathe

SPECIFICATIONS common to all Logan Lathes: Swing over bed, 10½", Bed width across ways, 6-15/16", Bed length, 43⅛", Size of hole through spindle, 25/32", Spindle nose diameter and threads per inch, 1½"—8, 12 Spindle speeds, 30 to 1450 r.p.m., size of motor, ⅓ or ½ h.p., 1750 r.p.m.; Preloaded precision ball bearing spindle mounting; Drum type reversing motor switch and cord; Precision ground ways, 2 prismatic "V" ways, and 2 flat ways.

THE pre-loaded ball bearing spindle mounting is one of the advanced design features which make Logan Lathes specially adapted to the needs of modern shops. With the resulting increased spindle speeds, full advantage can be taken of the high cutting speeds used with carbide cutting tools. No bearing adjustment is required within the full range of Logan spindle speeds, from 30 r.p.m. to 1450 r.p.m., regardless of the cut being taken. With Logan Lathes, consequently, the precise factory alignment of the spindle is not disturbed by periodic bearing adjustments, and original spindle accuracy is sustained. Grease-sealed, the ball bearings require no further lubrication or attention throughout their long service life. Maintenance costs and down time are kept at a minimum. The ball bearing spindle mounting is another reason why Logan Lathes increase output and decrease unit costs on production lines, and reduce the man-hours per cutting job in tool rooms. For full information on all models of Logan Lathes, see your nearest Logan dealer, or write direct for descriptive catalog. F-1

LOGAN ENGINEERING CO.

CHICAGO 30, ILLINOIS



Below: Close-up of Model LR Lathe showing Relieving-type Tailstock in "up" position, ready for loading shaft into collet chuck.

Rigidity OF SLENDER SHAFTS *increased* BY *Lo-swing Turning Method*

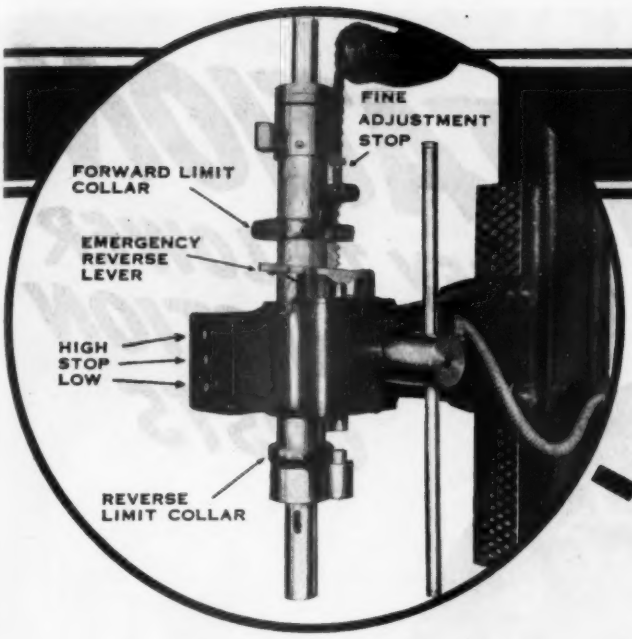
● The Tooling layouts above illustrate a new work-holding method used successfully on a Model LR Lo-swing lathe for automatically turning slender shafts. Use of a Steady Rest, which was necessary to control *springing* when the same work was turned between centers, has been eliminated.

An air-operated collet driver grips the shaft well in from the end, exposing only the part to be turned, thus reducing the shaft's effective length and further reducing springing because of the rigid grip of the collet. A Relieving-type Tailstock facilitates loading and unloading and makes possible minimum overhang of the spindle.

Positive location of the work against the shoulder, rather than by center depth, insures increased accuracy of shoulder lengths. *Greater shaft rigidity* has resulted in *longer Carbide Tool life.* Inquiries from manufacturers having shaft turning problems are invited.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

LATHE NEWS from SENECA FALLS



Avey FEATURE No. 1

THE Avey TYPE MA-6

AVEY-MATIC POWER FED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

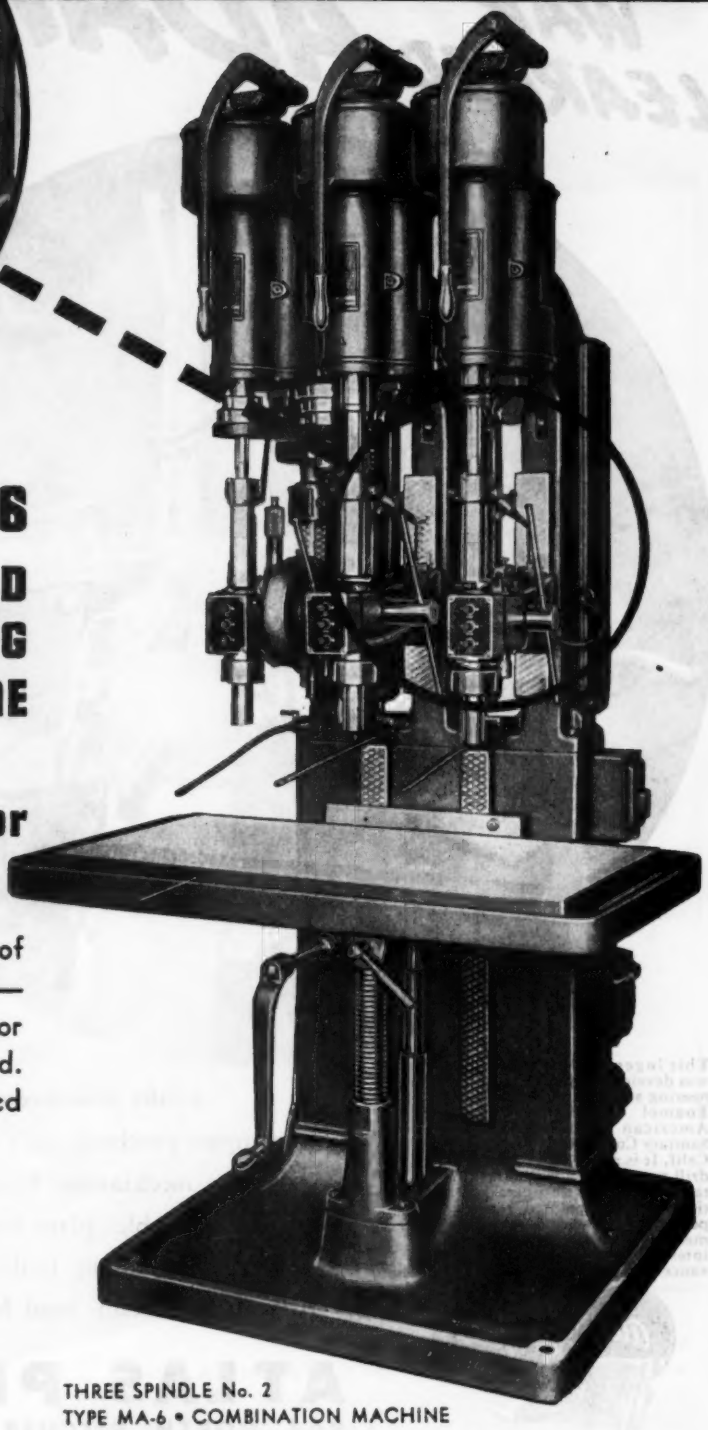
features

hand feed reversing motor for tapping

Dog control for depth — maintaining accuracy of depth within one-half revolution of the spindle — or emergency relief lever used to reverse motor if necessary before tapping cycle is completed. The natural motion of the spindle sleeve is used to control the reversing of the motor.

Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1 1/4" capacity in cast iron.

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.



THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

Avey DRILLING MACHINES

CINCINNATI • OHIO

THE MIND OF THE ENGINEER IS A BUSY PLACE

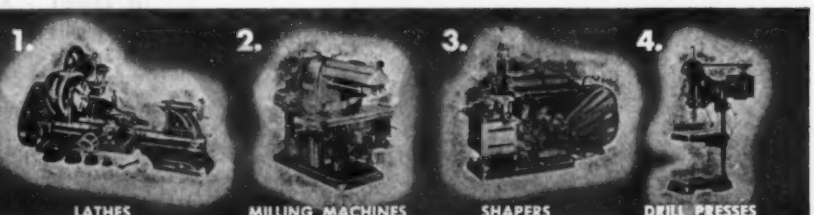
WAR LEARNED ADAPTATION KEY TO LOWER PRODUCTION COSTS

This ingenious machine was developed by the engineering staff of the Pacific Enamel Works of the American Radiator & Sanitary Corp., Richmond, Calif. It is made of 4 Atlas drill press heads for simultaneous, automatic operation. An air-operated jig positions the work in the machine, then after a timed interval air cylinders advance the drills.

The genius of American production stems from the eagerness of engineering minds to find new and better ways of doing things. Astonishing results have been obtained by coordinating the machining motions of compact precision tools with the new electric, hydraulic, and air controls and mechanisms. It opens a great new field of production possibilities —enables plant engineers to plan on lowering costs on many small part operations by building special low cost automatic machines with the Atlas 4 Tool Team. Send for other adaptation ideas and latest Atlas catalog.

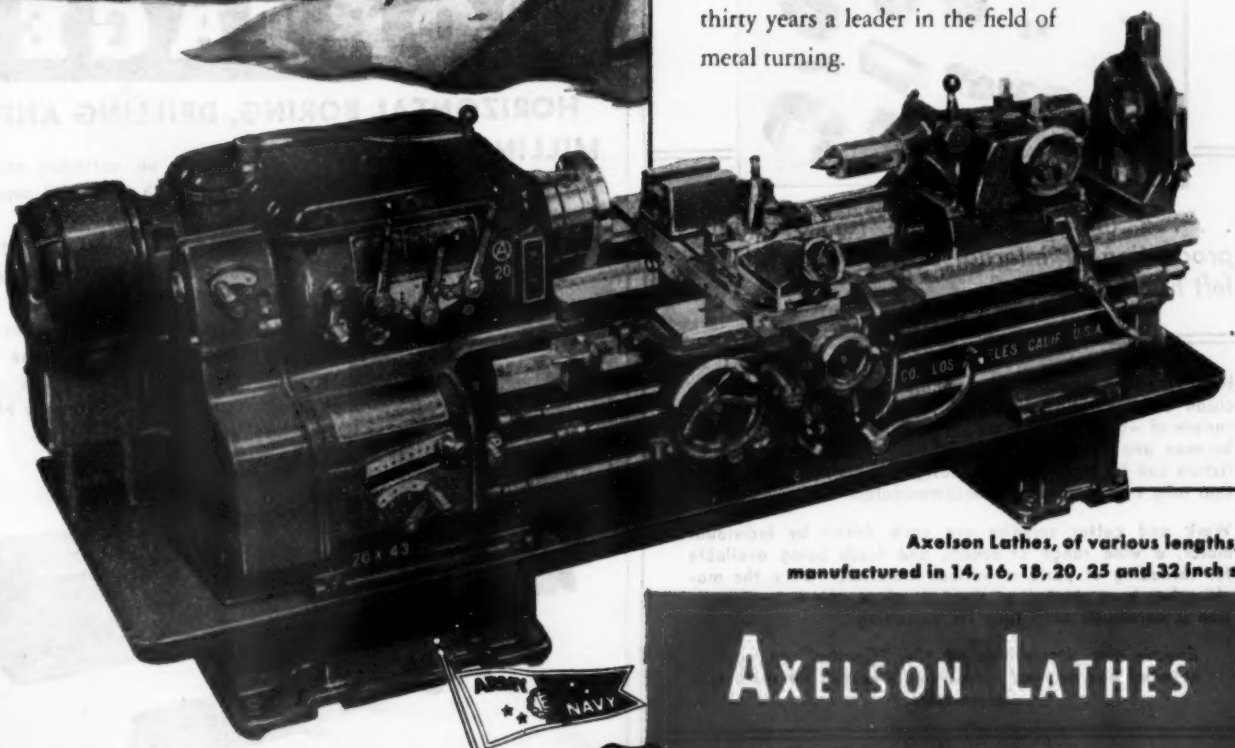
ATLAS PRESS COMPANY
904 NORTH PITCHER ST., KALAMAZOO 13D, MICHIGAN

Atlas 4 TOOL TEAM FOR SMALL-PART MACHINING



Brush-Off TIME

Uncle Sam, dusty from the wars, brushes off his shoes with the crest of Mars' battered helmet . . . Blessed Peace is here again bringing the problems of postwar industry . . . Brush-off time! . . . Industries served with the supreme metal turning advantages that the Axelson heavy duty Lathe provides, need not fear the "brush off" when they enter the keen competition of the new era . . . Quality counts today geared to economy and performance . . . In Lathes that means *AXELSON*—for thirty years a leader in the field of metal turning.



Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25 and 32 inch sizes

ARMY NAVY

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON LATHES

Dependable for over a Quarter Century

AXELSON MANUFACTURING CO.
6160 S. Boyle Ave. (Box 98, Vernon Station), Los Angeles 11, Calif. • 50 Church St., New York City 7 • 3844 Walsh St., St. Louis, Mo.

Any parts that can be chucked can be threaded on the COULTER HOB THREAD MILLER

. . . a universal machine for automatic production of internal or external right or left hand threads

Hob Threaded work can be handled with speed and precision on this rigid, simple fully motorized machine. The variety of work it is capable of handling is almost unlimited because any parts that may be held by chuck or special fixture can be threaded. The design of this machine is such that long work can also be accommodated.

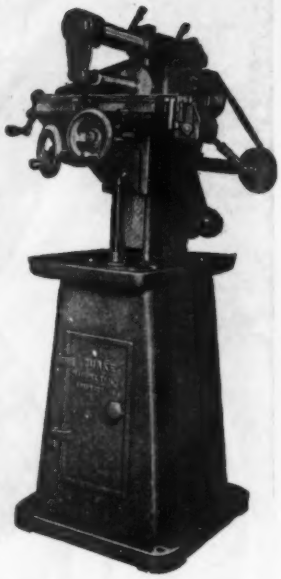
Work and cutter spindles are each driven by individual motor, a wide range of speeds and feeds being available for threading of parts of various materials. Once the machine has been started on the first piece, the entire operation is automatic until time for unloading.

Explore the possibilities of the "Coulter" on your external and internal threading by writing for further information.

THE JAMES COULTER MACHINE CO.
BRIDGEPORT, CONNECTICUT

BURKE MILLING MACHINES

. . . Put Your Small Work on a Production Basis!



Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

Complete Information Will Be Sent You Upon Request — Write!

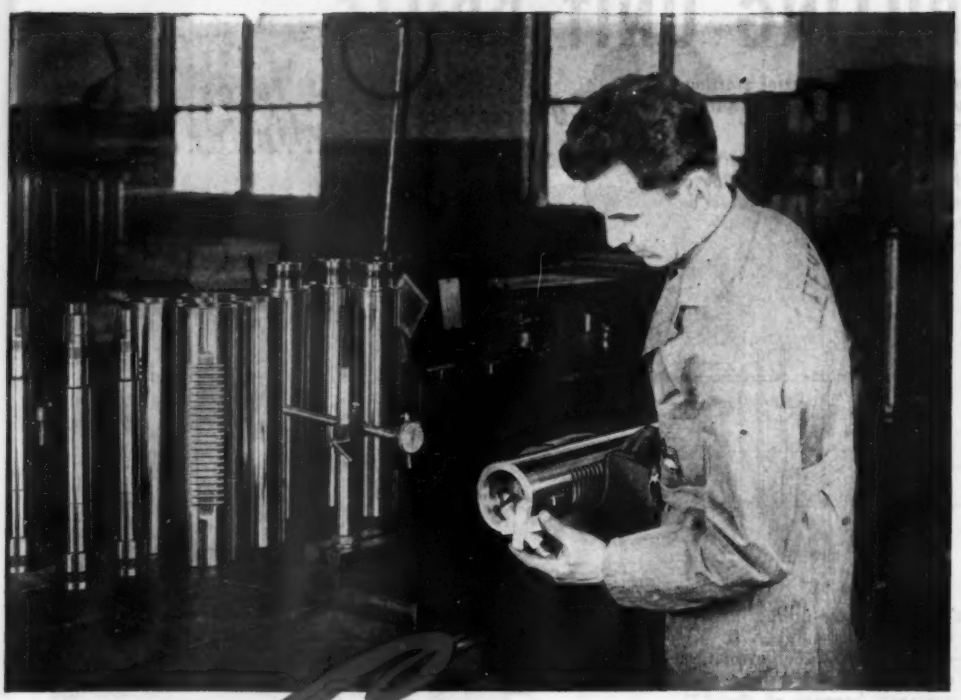
BURKE MACHINE TOOL CO.
CONNEAUT • • • OHIO

PORTAGE

HORIZONTAL BORING, DRILLING AND MILLING MACHINE NO. 4

• Featuring an extended saddle and table with outer rail support for maintaining exceptional accuracy on long work. Get fully acquainted with the many features of this modern Boring Mill. *Ask for a copy* of our new instructive bulletin which points out the numerous advantages of this new Horizontal Boring, Drilling & Milling Machine.

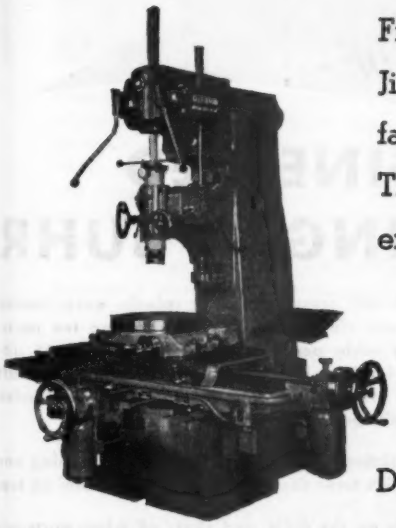
THE PORTAGE MACHINE CO.
AKRON 11, OHIO



Assembling a spindle and quill for a Cleereman Jig Borer.

Cleereman JIG BORER

GREATER PRECISION RESULTS FROM SMOOTH POWER FLOW



From the motor shaft right through to the spindle, the Cleereman Jig Borer is designed and built for vibrationless operation—a prime factor in the production of work to the extreme limit of precision. The smooth, silent flow of power to the spindle is an outstanding example of Cleereman skill in producing fine machine tools.

Write for catalogs on Cleereman Jig Borers and Cleereman Drilling Machines.

Cleereman Machine Tool Co. of Green Bay, Wisconsin, organized in 1908 and affiliated with Bryant Machinery & Engineering Company, manufactures fine machine tools including Cleereman Precision Jig Borers and Cleereman Drilling Machines.

BRYANT
Machinery & Engineering
Company

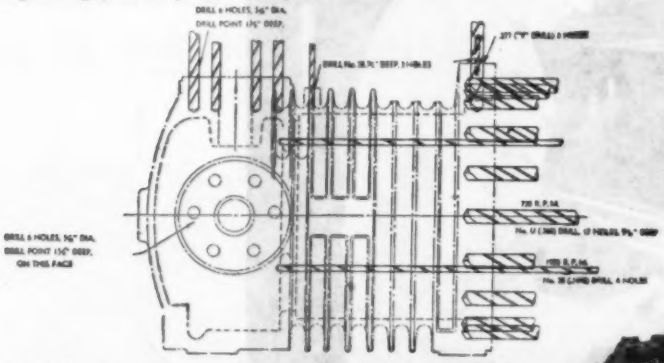
General Office
400 West Madison Street, Chicago 6
Representatives In Principal Cities

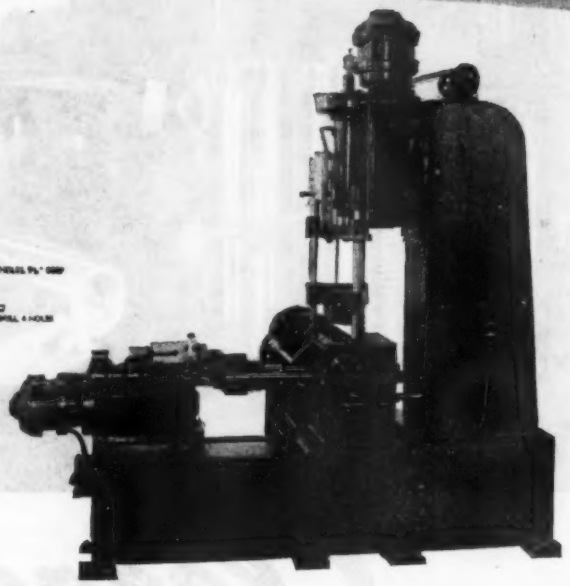
HOEFER'S DRILLING UNIT DRILLS

36 holes in 3 faces of Compressor Cylinder Block

• This three-way machine has central electrical control starting all motors simultaneously as well as centralized hydraulic system which handles all feeds at the same moment.

Hoefer Units are never obsolete. They can be used, with perhaps a new base in the construction of a new drilling set-up, for a new part. These units in service now will be of great value in the coming changeover to peace time production.





Three faces of the compressor cylinder block were drilled in sizes indicated on drawing—36 holes in all. Drills turned 70' per minute with feeds for large drills—.008" to .009" per revolution and for smaller tools—.004" per revolution. Total drilling time 14 seconds including long rapid approach because of the #25 holes (see drawing) at bottom of cylinder. This of course does not include loading or unloading.

Write today—get details regarding your needs from our experienced engineers

Hoefer's Whole Business is Holes • • • •

HOEFER MFG. CO. *Freeport, Ill.*

It is being done!

150,000 HOLES AN HOUR!

ENGINEERED RETOOLING *by* BUHR

Buhr tooling on a standard drill press, with a 51 spindle water cooled drill head, bushing plate and clamping fixture for holding ten parts. Special compound indexing table permits positioning parts to 65 different stations for drilling 4,590 ¼ inch holes in an aluminum aircraft cooler plate. Safety features prevent drills from feeding down until index table is locked in place by plunger.

This machine is practically frictionless. Illustration shows man turning one spindle with two fingers, which turns the other fifty and the motor on top.

A pump puts coolant directly on the drills, and shuts off when parts are being loaded or unloaded in the fixture.

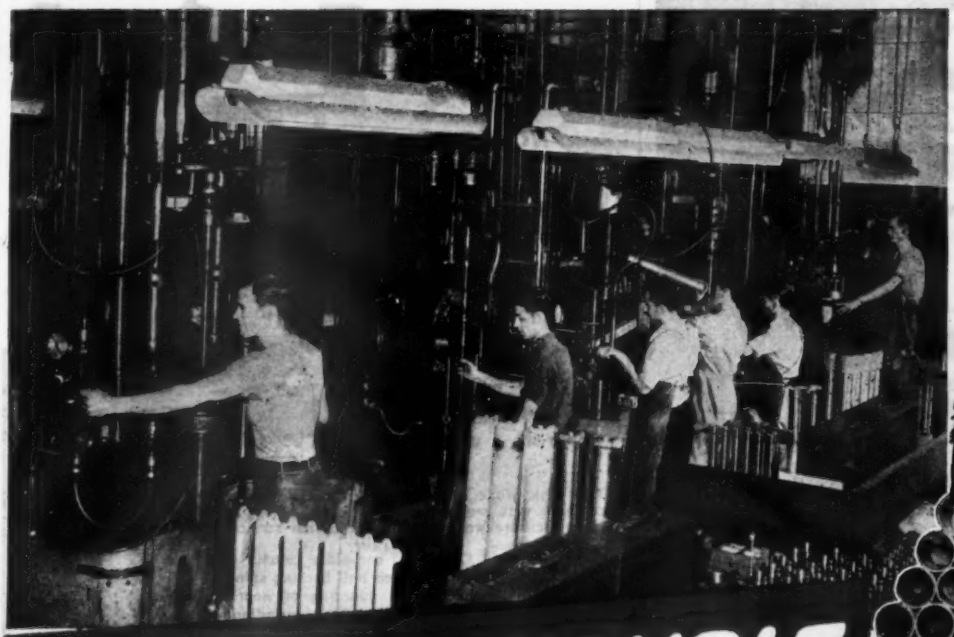
ALL GEARS ARE SHAVED AND INDUCTION HARDENED FOR QUIETER OPERATION, LOWER POWER CONSUMPTION AND MORE TROUBLE-FREE PRODUCTION HOURS.

Buhr Engineers are available for discussion of retooling. Write us about your problems or send blueprints. We'll give you the correct answer.

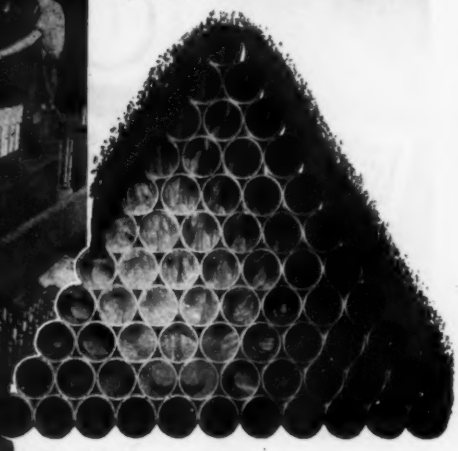
BUHR MACHINE TOOL COMPANY

•

GREEN & DAVIS
ANN ARBOR, MICH.



(Left) A battery of BARNESDRIL *Honers installed at Coast Centerless Grinding Company. Below, pyramid of finish honed Chrome-Moly Hydraulic Landing Gear Cylinders. Note mirror finish of bore.*



ANOTHER EXAMPLE

OF REDUCED COSTS
THROUGH INCREASED PRODUCTION
with
BARNESDRIL HONERS

Coast Centerless Grinding Company Reports Substantial Savings on Rough and Finish Honing of 28″ Steel Hydraulic Cylinders

● At Coast Centerless Grinding Company a battery of BARNESDRIL Honers is employed for rough and finish honing various sizes and types of landing gear cylinders. One such cylinder is a 28″ Chrome-Moly steel hydraulic cylinder with 3⅛″ bore. These cylinders are rough honed, with .020″ stock removal, at the rate of 20 per hour. The finish honing operation removes .005″ stock at 10 cylinders per hour. This is just one more example of how progressive manufacturers are cutting costs through increased production, by adapting BARNESDRIL Honers to their finishing work.

Honing Insures Finer Finish, Greater Accuracy

Coast Centerless Grinding Company is one of the many manufacturers turning to honing for finer finish and greater accuracy. With BARNESDRIL Honers, finish accuracy of .0005″ or less is easily obtained and, in high speed production, surface finishes of 2 to 3 micro-inches can be maintained. Honing insures straightness and roundness of bore and mirror finish on both internal and external work.

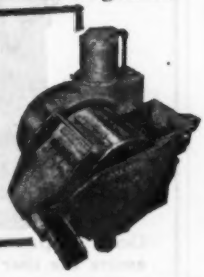
Versatility of BARNESDRIL Honing Machines

There is a BARNESDRIL Honing Machine for practically any finishing requirement, for they are built in vertical, horizontal and angular types with both single and multiple spindles. Honing can be profitably adapted to finishing work up to 42″ diameter and more than 75′ in length.

Call on a BARNESDRIL engineer today and learn how you can advantageously adapt honing to your work. There is, of course, no obligation.

NEW METHOD FOR CLEANING COOLANT

The BARNESDRIL Magnetic-Automatic Coolant Separator embodies a revolutionary method, effecting greater economy, for cleaning honing and grinding coolant. Separator operates on the principle of magnetic attraction and harmful metal and abrasive particles are automatically removed from coolant as it flows to reservoir for recycling. Three sizes, for handling ten, twenty and forty gallons of coolant, are available.



FURTHER INFORMATION FREE

You can obtain more comprehensive information on how you can use BARNESDRIL Honers to advantage by writing today for your free copy of Bulletin A-121. The BARNESDRIL Separator is thoroughly described in Bulletin A-151.

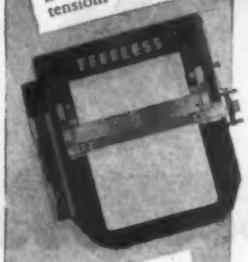
Barnes Drill Co.

830 CHESTNUT STREET
ROCKFORD
ILLINOIS, U. S. A.

PEERLESS Features *That Boost* Production Records

Finger-Tip Control of the feed pressure speeds up accurate setting for maximum Sawing speeds.

Four-Sided Saw-Frame permits high blade tension.



Conveyor with automatic Micro-set Length Gauge can be added right on the job.

PEERLESS has exclusive features that help you make better production records on metal Sawing . . . Four-Sided Saw-Frame with Blade-Backing-Plate . . . Finger-Tip Feed Pressure Control . . . and Micro-set Length Gauge.

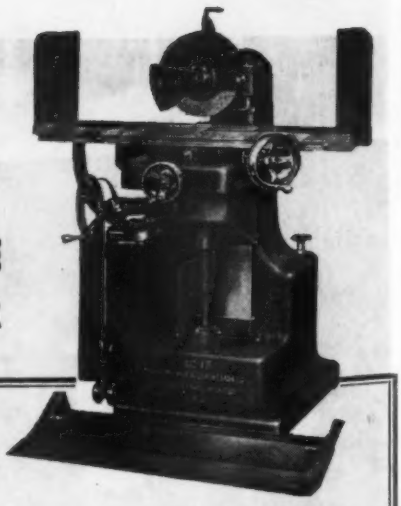
These are the principal features that give smooth, vibrationless Sawing at high speeds . . . top quality at lower cost! All your tough metal Sawing operations are greatly simplified when the work is planned for a Peerless Hydra-Cut. Find out today how these precision cutting tools—with all their exclusive features — can make better production records in your shop. See your local Peerless dealer or write direct for complete information.

Write Dept. RM-945

14" Hydra-Cut Saw in Consolidated Vultee Plant.

PEERLESS
MACHINE COMPANY
RACINE · WISCONSIN

GRAND RAPIDS NO. 15 HAND FEED SURFACE GRINDER



. . . a rugged machine for fine, accurate work

This high grade, motor driven machine will handle all work within its capacity with maximum convenience. Among the features which assure fine, accurate work and long precision service are the following:

. . . heavy, one-piece column and base
. . . precision ball bearing spindle
. . . careful guarding of wearing surfaces
. . . provision for wet grinding

This machine can be furnished with coolant system or dust collecting system.

Longitudinal Table Movement—19"
Transverse Table Movement—8½"
Vertical Movement—12"
Table—6"x18"

Send for illustrated literature giving further details.

GALLMEYER & LIVINGSTON CO.
330 Straight Street, Grand Rapids (4), Mich., U. S. A.

KEYSEATING
The Modern Way

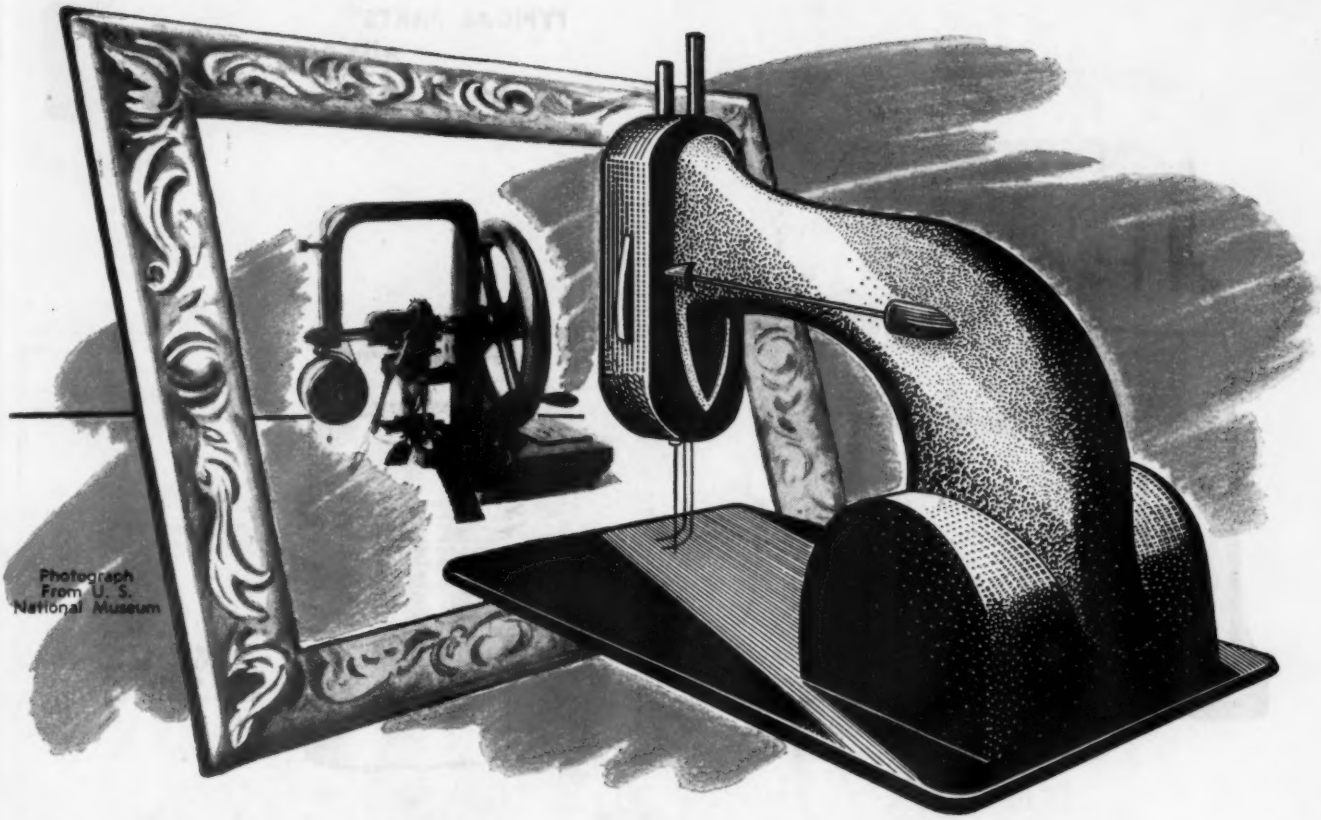
Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY
403 EXCHANGE ST. ROCHESTER, N. Y.



SMOOTH SEWING AHEAD

Tomorrow's streamlined sewing machines will hum busily in millions of postwar homes . . . for many of their precision parts will be mass-produced speedier, better and more inexpensively by modern broaching methods.

Scores of leading manufacturers, desiring maximum efficiency in the production of their postwar products, have placed their problems squarely upon the broad shoulders of the Lapointe engineering staff.

In each instance, Lapointe experts made a thorough study of both product and plant before submitting a recommendation. Usually, it disclosed how a switch to broaching of precision parts would bring about a substantial saving in money, time and valuable floor space. Such a recommendation should be of value to you, too, so contact the Lapointe engineering staff without delay.

★

IF YOU PLAN FOR TOMORROW . . . CONSULT LAPOINTE TODAY

Special V-7 with 4 broaches for finishing inside surfaces of propeller component.

★ ★ ★ ★ ★ ★ ★

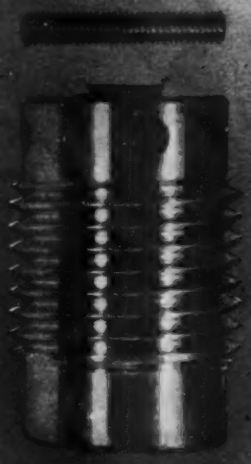
THE *Lapointe*

MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

TYPICAL PARTS
. . . . with production time . . . .



Range Pre-Heat Treated High Tensile Alloy Steels ¼" x 40 Pitch 1.5 Sec. to 1-3/16" x 8 Pitch 12 Sec.

Exceptionally Close Tolerances Over a Wide Pitch Range Assured at Fast Production Rates

Steinle Centerless

THREAD GENERATORS

Write for illustrated literature giving further details

Typical Parts with Production Time

This machine . . . with an enviable record for producing highly accurate threaded parts . . . employs the principle of the centerless grinder using hardened steel thread-forming rolls to produce threads having the required strength, accuracy and finish for aircraft, automotive, electrical, refrigerator and other equipment requiring high precision.

The hardened steel thread-forming rolls have their peripheral faces ground with a precise, negative reproduction of the helix angle, pitch and thread form to be generated. One roll revolves about a stationary axis, while the sizing roll, mounted on a slide, feeds hydraulically into the work to a pre-determined depth, is electrically tripped and returned to its starting position. There is no axial movement of the workpiece during the generating cycle, the blank merely revolving in contact with the generating rolls. The workpiece, when removed from the machine, is threaded exactly to the length presented to the rolls.

All classes of threads can be produced on this machine which has a capacity for generating threads from ⅛" to 1-3/16" diameter in high tensile, heat-treated stock, and up to 2¼" diameter in soft steels and non-ferrous metals.

In addition to offering a wide range of pitch diameters on a single machine, the Steinle Centerless Thread Generator will produce threads on a high production basis to closer tolerances than are called for by U. S. thread standards. Once the machine is set for size, it can be operated successfully by unskilled men or women. Simple controls help operator maintain high output.

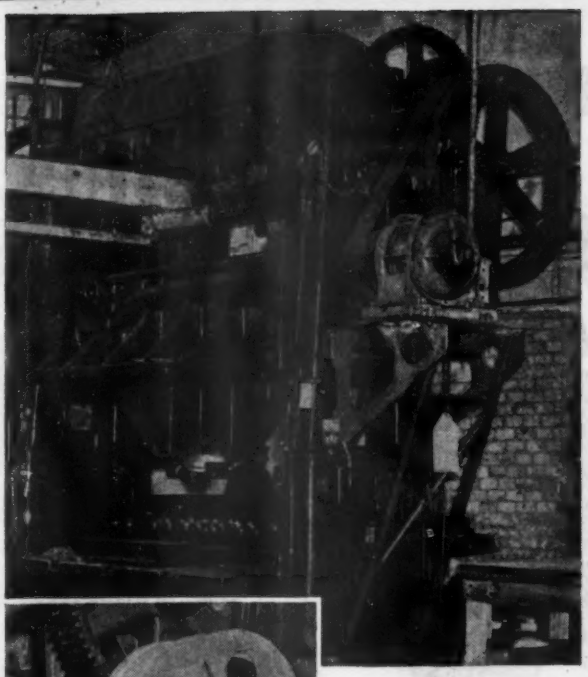
[redacted]

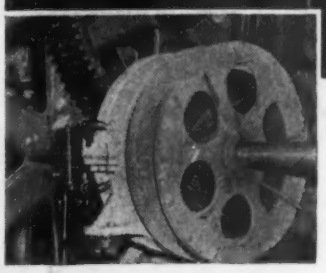
FAWICK CLUTCHES
IN HEAVY-DUTY DRIVES

Machines that make quick starts and stops—under stress and shock—are proving the value of the Fawick Clutch.

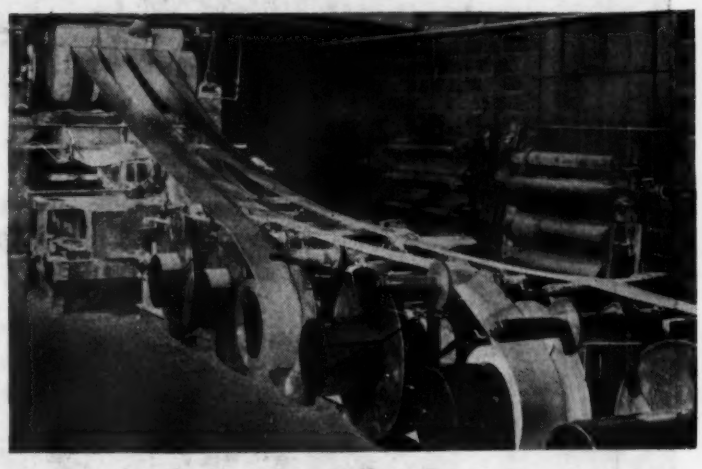
This new clutch transmits power and absorbs torque through a cushion of rubber and air. It has no springs, arms or toggles, requires no lubrication or adjustments. Maintenance costs are unusually low, and power is controlled within close limits.

If you want this new clutch efficiency and economy, let us help you *engineer* Fawick Clutches for *your* machines. Book on request.



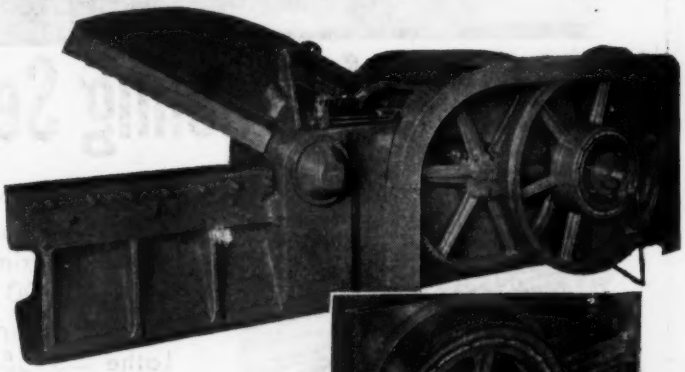


400-TON PRESS, equipped with Fawick combination Clutch and Brake. Inset shows clutch and brake unit.



STEEL ROLLING MILL equipment finds Fawick Clutches effective an economical, and suited to rigid product control.

POWER PRESS, Fawick-equipped, has smooth starts and stops. "Inching" provided for without special equipment. Maintenance costs low.



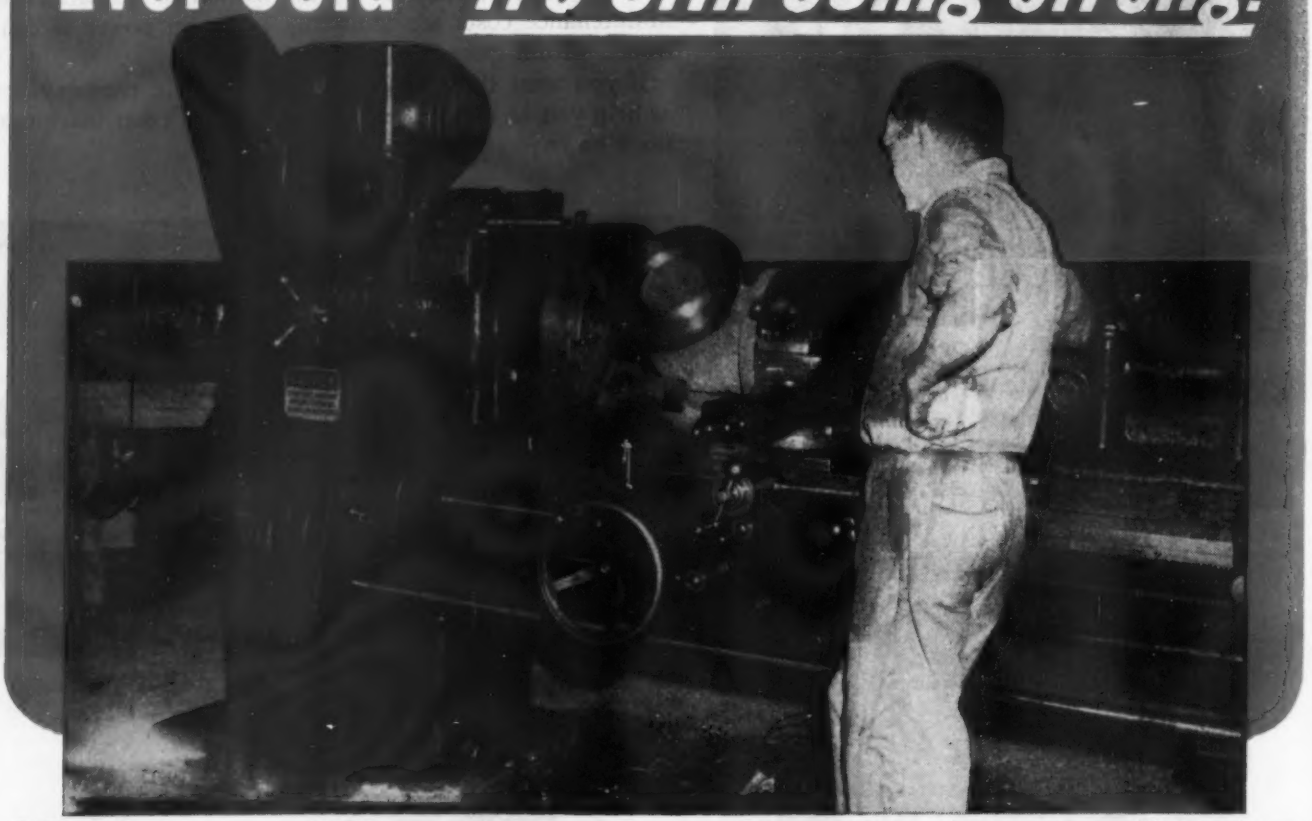
ALLIGATOR SHEAR operates smoothly through Fawick Clutches and Brakes. Inset shows clutch unit.

FAWICK *Airflex* CLUTCH

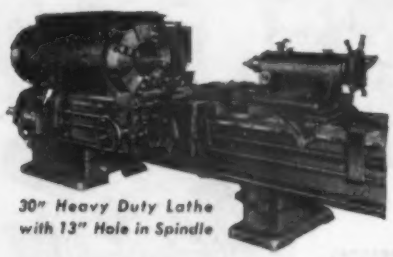
FAWICK AIRFLEX CO., INC. • 9919 Clinton Road, Cleveland 11, Ohio

In Canada, Reynold-Connelley Ltd., Montreal, Toronto, Vancouver • In Britain, Crofts Engineers, Ltd., Bradford, England

Here's the FIRST Hydratrol Lathe Ever Sold — *It's Still Going Strong!*



10 Years of Grueling Service for Lathe #5155



30" Heavy Duty Lathe with 13" Hole in Spindle

5 SIZES—18" to 36"

Small	18" up to 7½"	Hole
Medium	24" up to 12"	Hole
Large	27" up to 13"	Hole
Large	30" up to 14"	Hole
Large	36" up to 16½"	Hole

(Standard type lathes, 16" to 36")

THIS HYDRATROL LATHE was used by the original purchaser 9 years, most of that time 24 hours a day, 7 days a week. During this period the purchaser bought and used $700,000.00 of HYDRATROL LATHES!

Having a surplus of this particular size, the owner sold Lathe #5155 in 1944, to the Corpus Christi Machine Shop, Corpus Christi, Texas, in whose shop the above photo was taken.

The new owner recently wrote us: "Hydratrol Lathe #5155 has given excellent service, and has never given any trouble. It is rugged enough to handle heavy work and still maintain the extreme accuracy originally built into the machine."

LEHMANN MACHINE CO., St. Louis 3, Mo.

HYDRATROL LATHES*

*LARGE HOLLOW SPINDLE TYPE

FREE

NEW GUIDE TO PROFITABLE PRODUCTION MILLING

Write today*
FOR NEW 64 PAGE MILLING BOOK
This new Sundstrand Milling methods book will prove valuable to you today and for planning future milling jobs. It's FREE.
PRACTICAL
Milling Methods
SUNDSTRAND
MACHINE TOOL COMPANY

*ASK FOR BOOK No. 140.

64 pages of helpful production milling information

Most production milling problems can be solved by one or a combination of only three different methods. This new Sundstrand book shows how. It offers a new, direct and simple approach to solving production milling problems *profitably* . . . includes applications of milling in all types of metal working plants, all metals. You'll get some fresh ideas from this book . . . ideas you can use now or later.

Over 60 actual problem solutions and tooling diagrams

Not theory, but actual, practical milling production methods are analyzed in this new book. Included are over 60 specific applications of standard, modified standard and entirely special machines — *with the actual milling production methods revealed in tooling diagrams.* Each example shown illustrates the most practical solution to one specific problem. Examples included range from slotting small lock parts to process milling cylinder blocks.

How you can use this information to simplify your milling production

The milling problems illustrated in this book may include jobs similar to yours. Checking your jobs with the simple methods offered will help determine the most profitable solution. Write today.

A FEW OF THE MILLING JOBS COVERED . . .

These are but a few of the milling jobs illustrated in the new 64 page book:

- Sweep Milling Supercharger Impellers.
- Contour Milling Hose Coupling Bodies.
- Milling Various Turbine Bucket Blades.
- Process Milling Cylinder Blocks.
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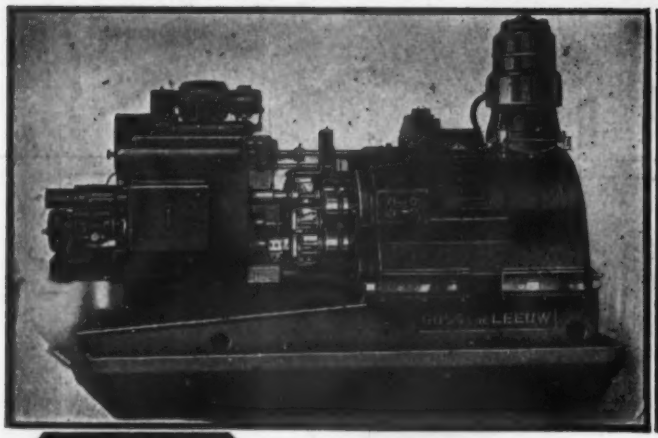

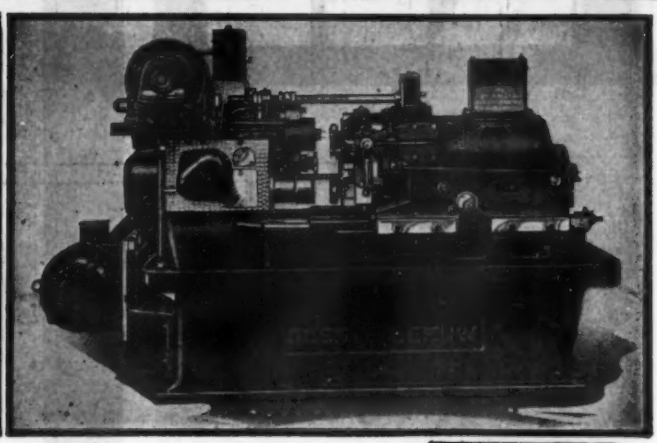

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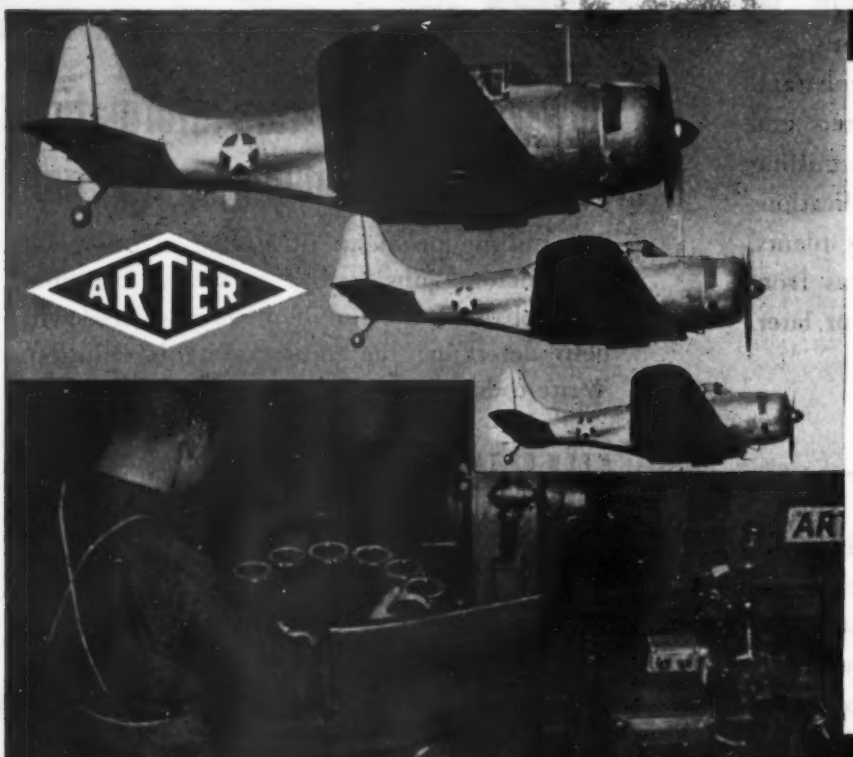

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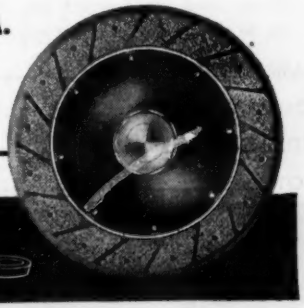

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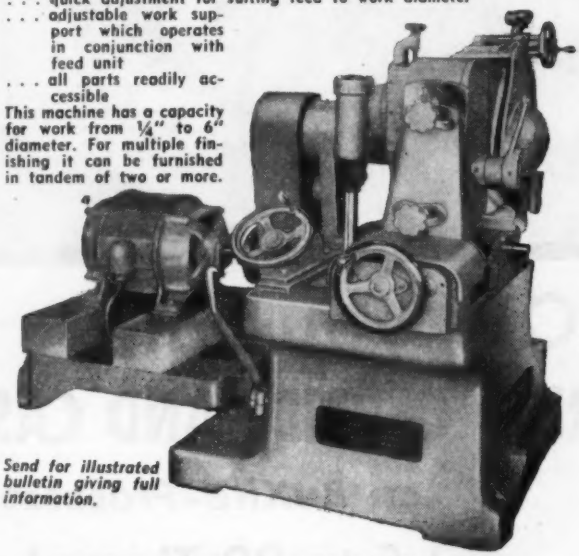
This machine has a capacity for work from ¼" to 6" diameter. For multiple finishing it can be furnished in tandem of two or more.



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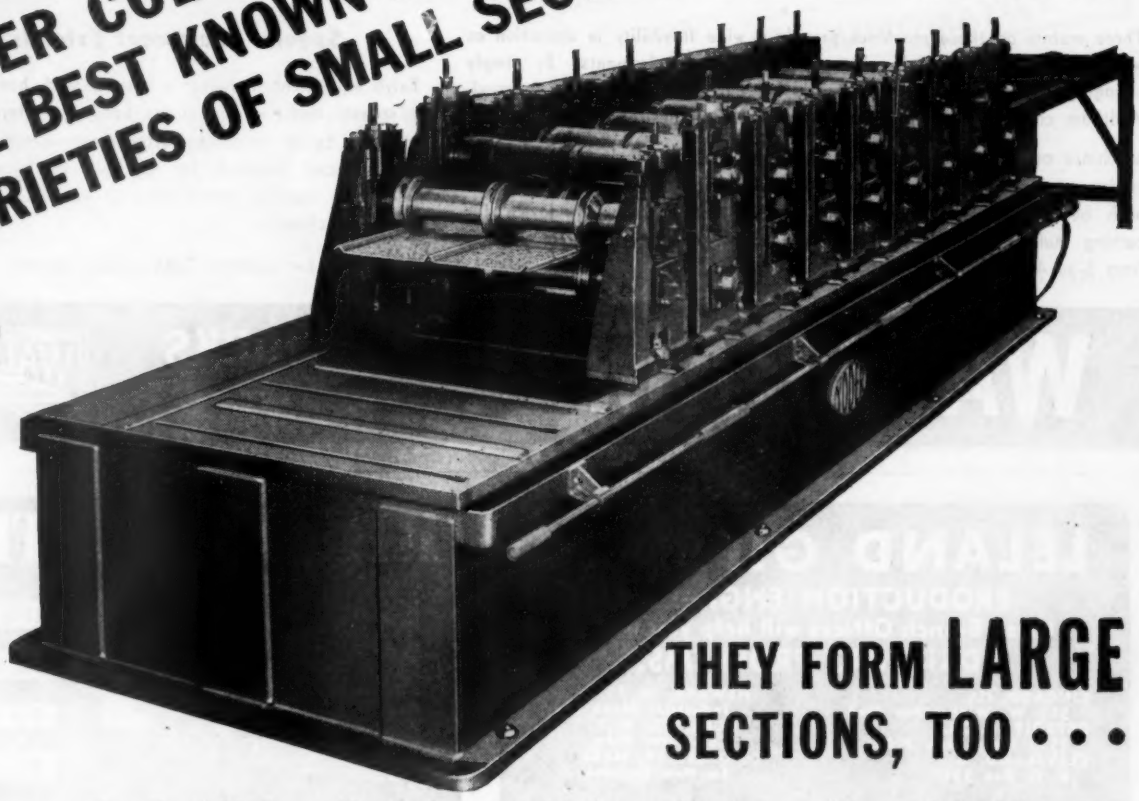

THEY FORM LARGE SECTIONS, TOO • • •

Standard Yoder roll stands, assembled on wide bases with special wide rolls, are profitably used in the high production of formed sections up to 30 inches wide (stock size). Typical examples would be—roofing sections, refrigerator shells, steel auto body components, many types of corrugated sections, steel wall panels and a variety of beaded, channeled, flanged or crowned section for special purposes, rapidly formed from flat or coiled sheet stock in any required gauge. Let a Yoder engineer show you how this or other Yoder Metal Working Machinery can cut costs in YOUR production.

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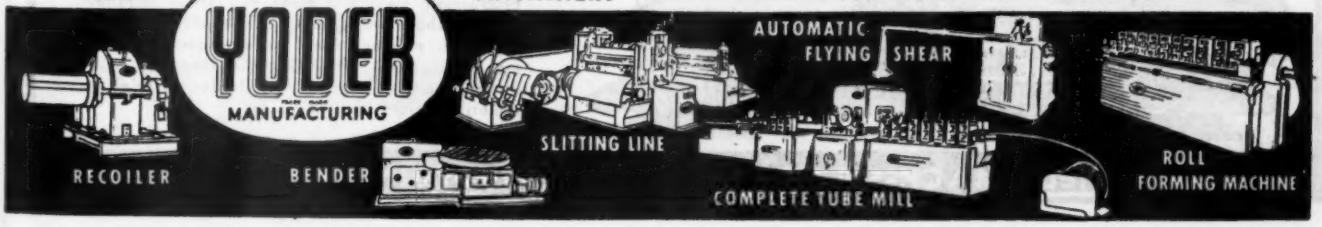
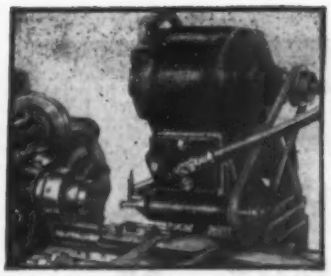
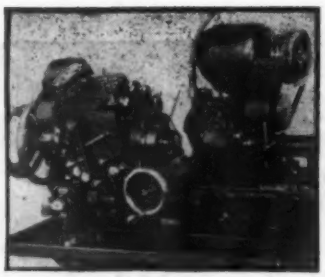
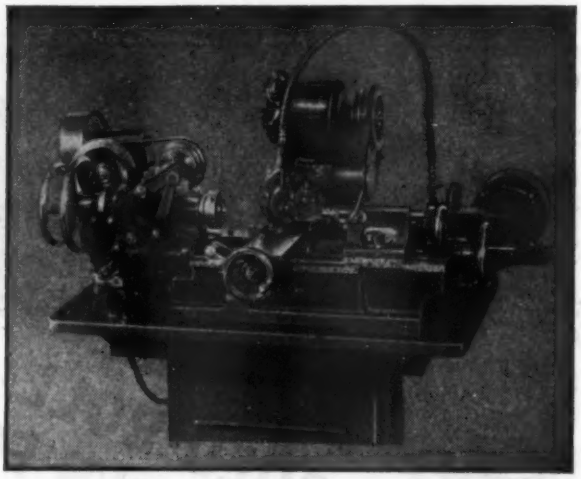




Machine equipped with Internal Milling Attachment



Machine equipped with Relieving Head



ALL STANDARD FORMS OF THREADS CAN BE PRODUCED TO CLOSEST TOLERANCES ON

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Three motors on these machines provide a wide flexibility in operation as well as a constant supply of coolant for all requirements. By simply changing ratios, speeds are suitable for cutting either brass or steel. Waltham can furnish cutters for any thread form desired.

Machines are mounted on cabinet base with two shelves inside. Standard equipment includes: three motors with push button start and automatic or push button stop—follow rest—one milling cutter—indexing device for cutting multiple threads—5 pitch lead screw—change gears for cutting from 5 to 40 threads per inch.

Special Equipment Extends Utility

Extra equipment includes a special work head for relieving—a special motor driven cutter head for internal threading—a multiple cutter threading attachment—automatic cam operation—special tailstock for multiple cutter work—translating gears for cutting metric threads—metric lead screw—plain taper attachment.

Write for Bulletin 244A giving detailed information.

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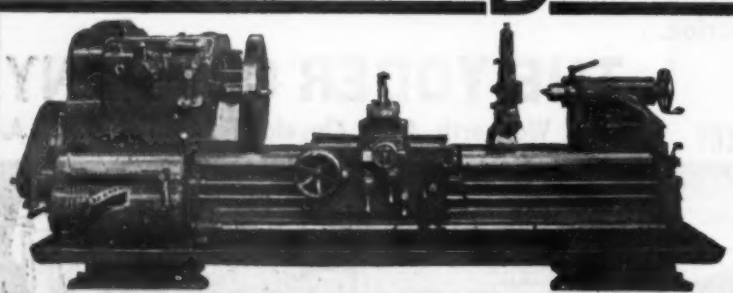

for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes—flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

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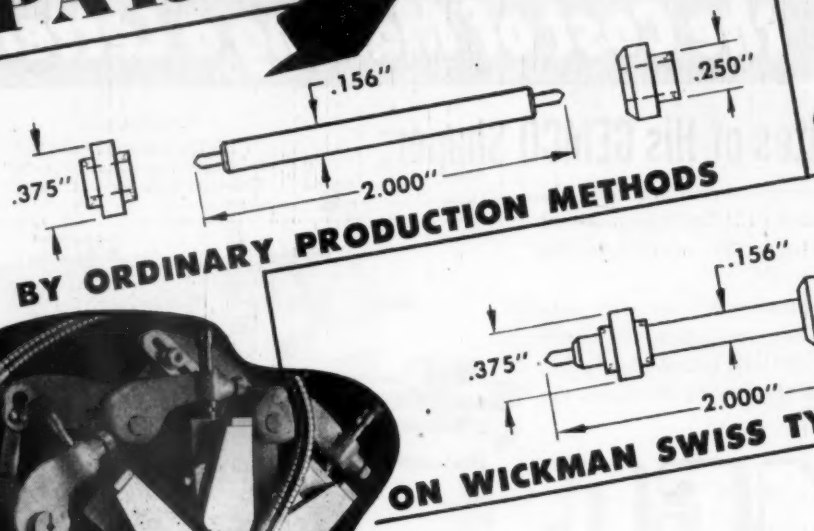
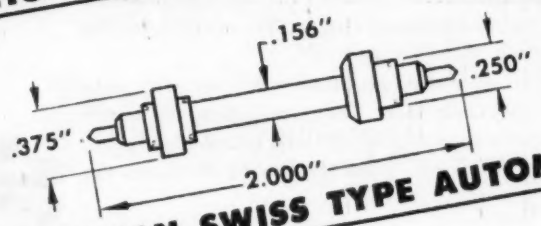
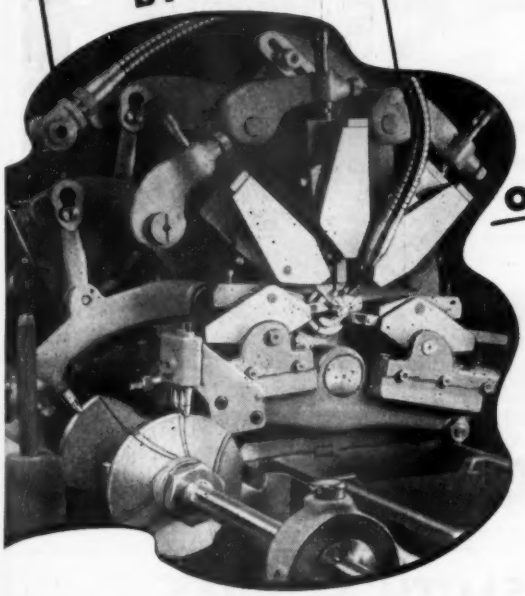
3 PARTS OR ONE



BY ORDINARY PRODUCTION METHODS



ON WICKMAN SWISS TYPE AUTOMATICS



In a single operation, a Wickman Swiss Type Automatic can produce many small parts which could only be duplicated by assemblies manufactured on conventional screw machines and by secondary operations. In addition, tolerances are held to closer limits and finer finishes are secured, combined with a tendency toward reduced scrap losses.

Wickman Automatics turn multiple diameters, pivot points and tapers of any angle, back shoulders and recesses in a single operating cycle. Attachments provide for drilling, reaming, counterboring, threading, tapping, slotting, etc. simultaneously with the machine operations.

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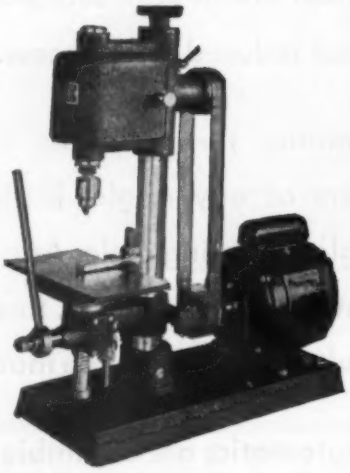

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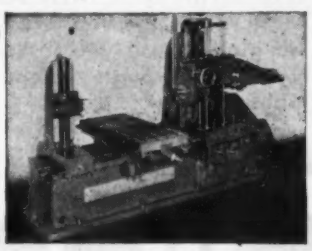

Standard Universal 3" Spindle Machine

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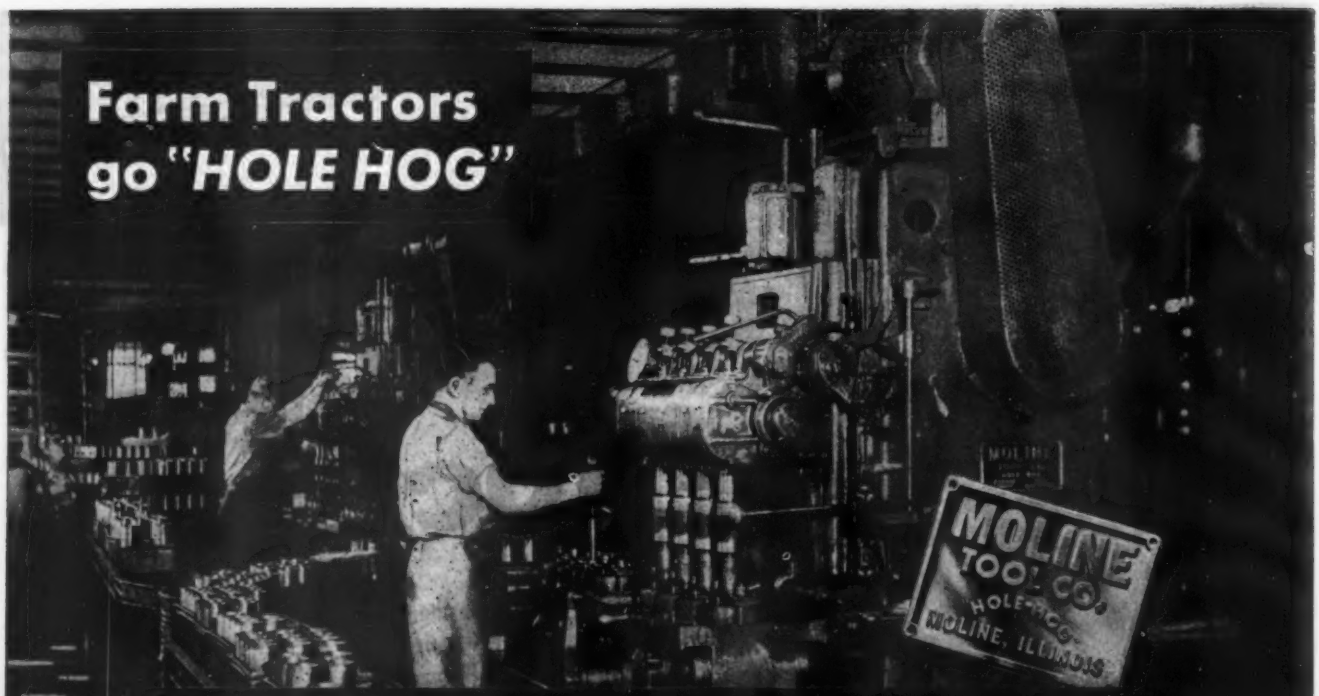

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Photo Courtesy International Harvester Company

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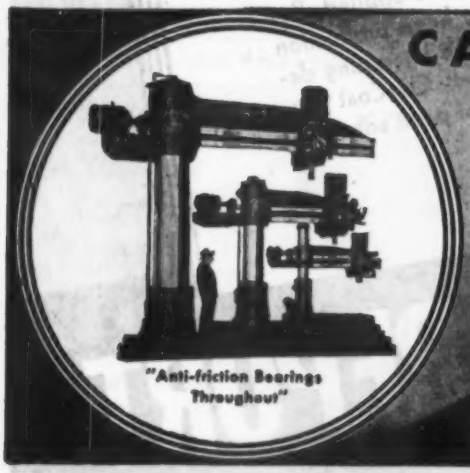

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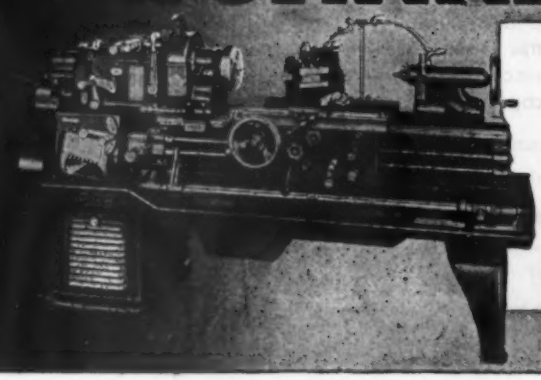

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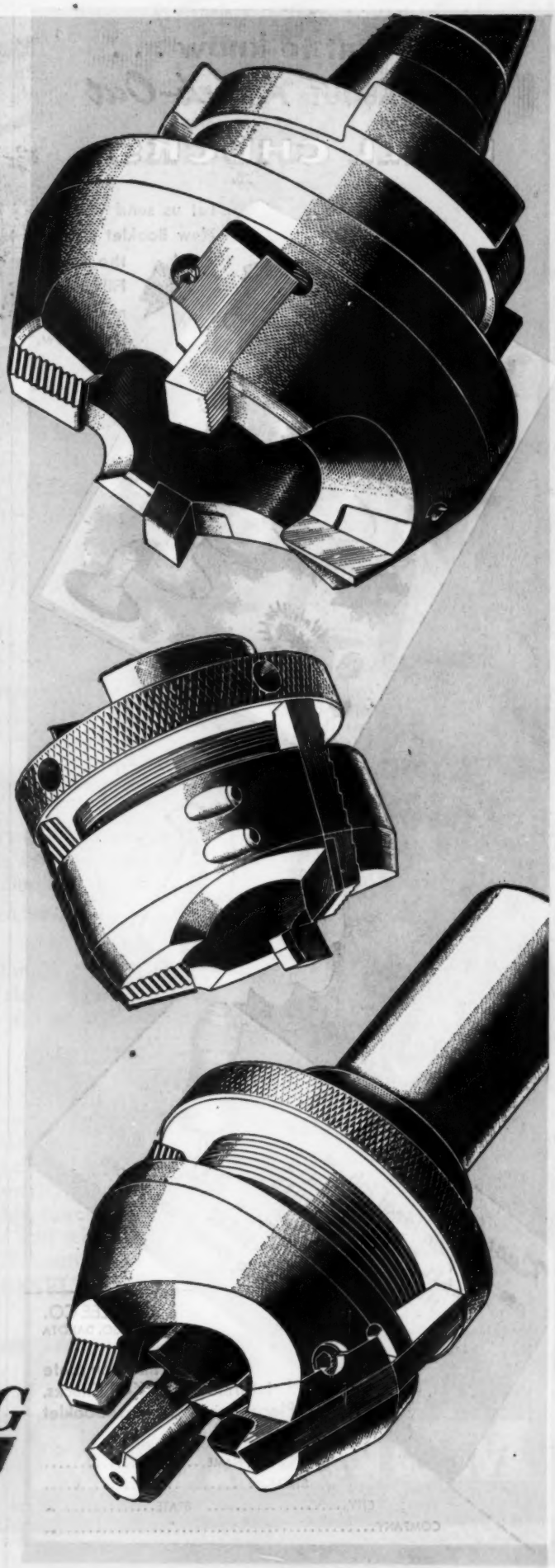
THE CINCINNATI LATHE & TOOL CO.
Rogers Road, Oakley SPECIALISTS SINCE 1906 Cincinnati, Ohio

Custom built Hollow Mills



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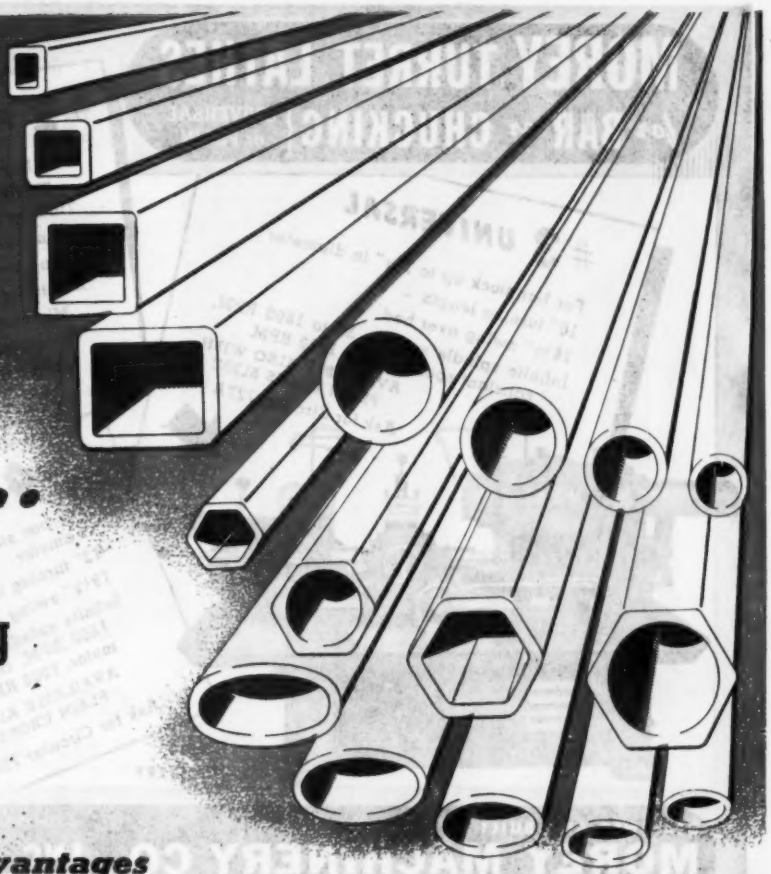

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UPON REQUEST! Bulletin 17-B, Tubing . . . Bulletin 22-B, Sheet and Strip. For Wire, Rod and Bar, see Bulletin 31-B . . . Extruded Aluminum Shapes, Bulletin 35-B. And don't forget Catalog 100-A. "Reynolds Aluminum. Its Important Role in Tomorrow's Products."

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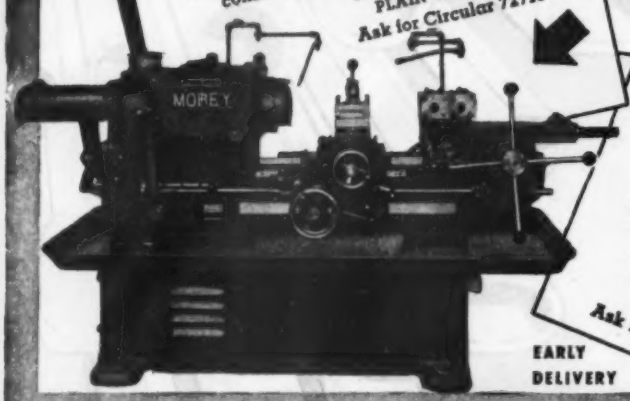

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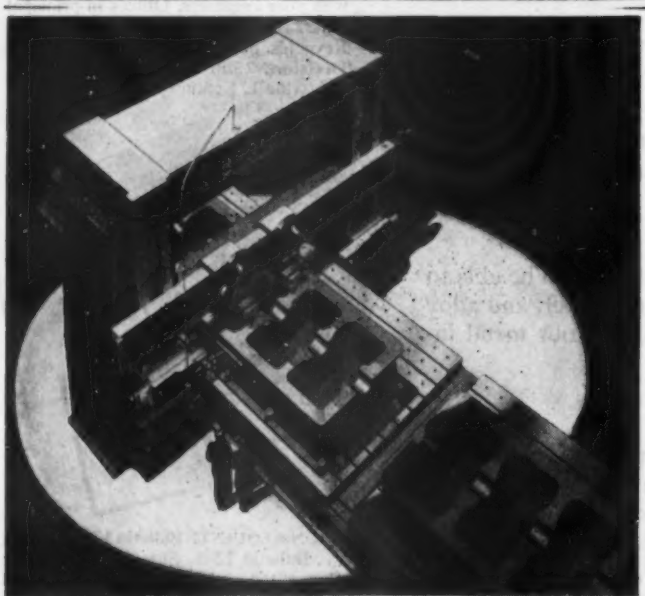

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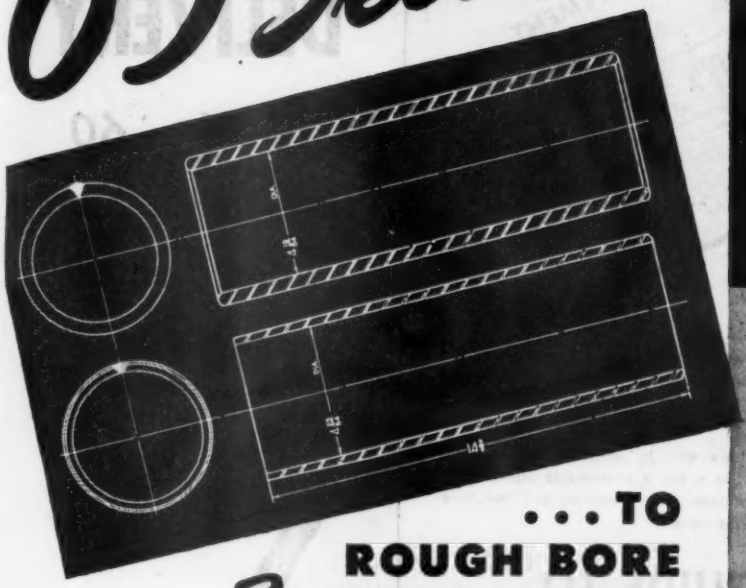

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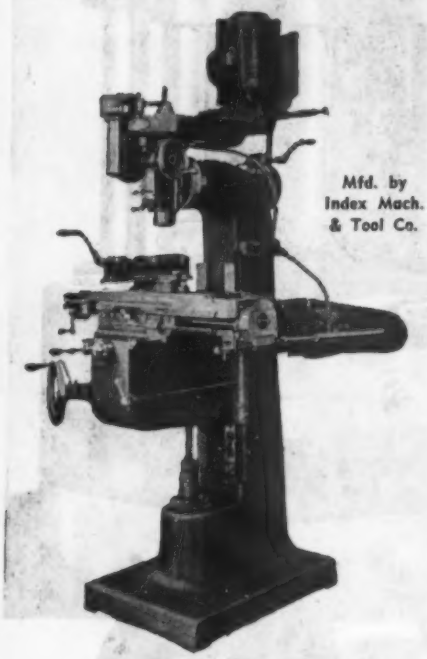

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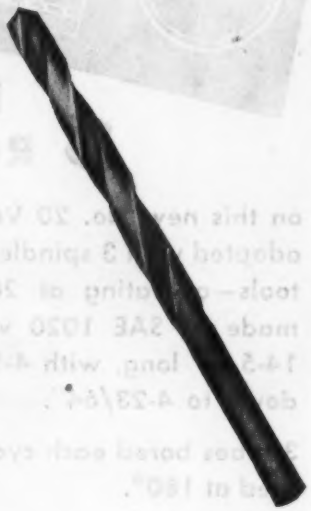

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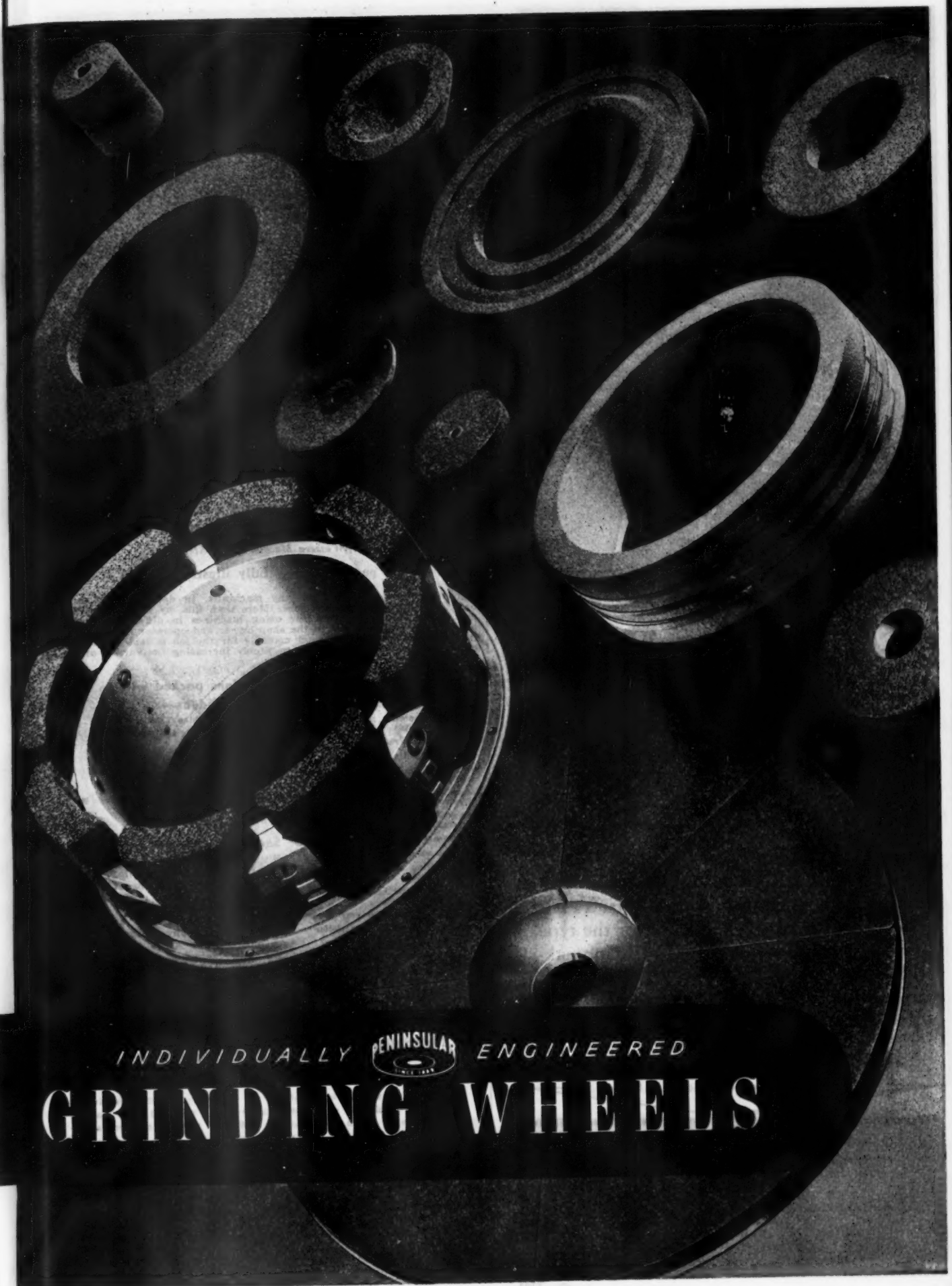
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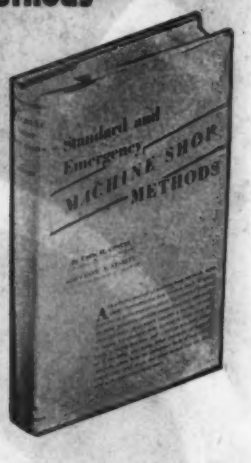

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20

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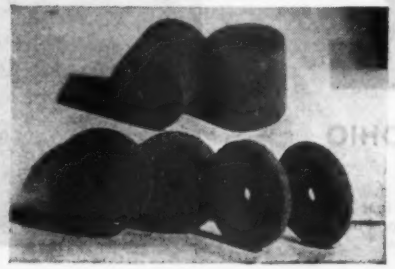

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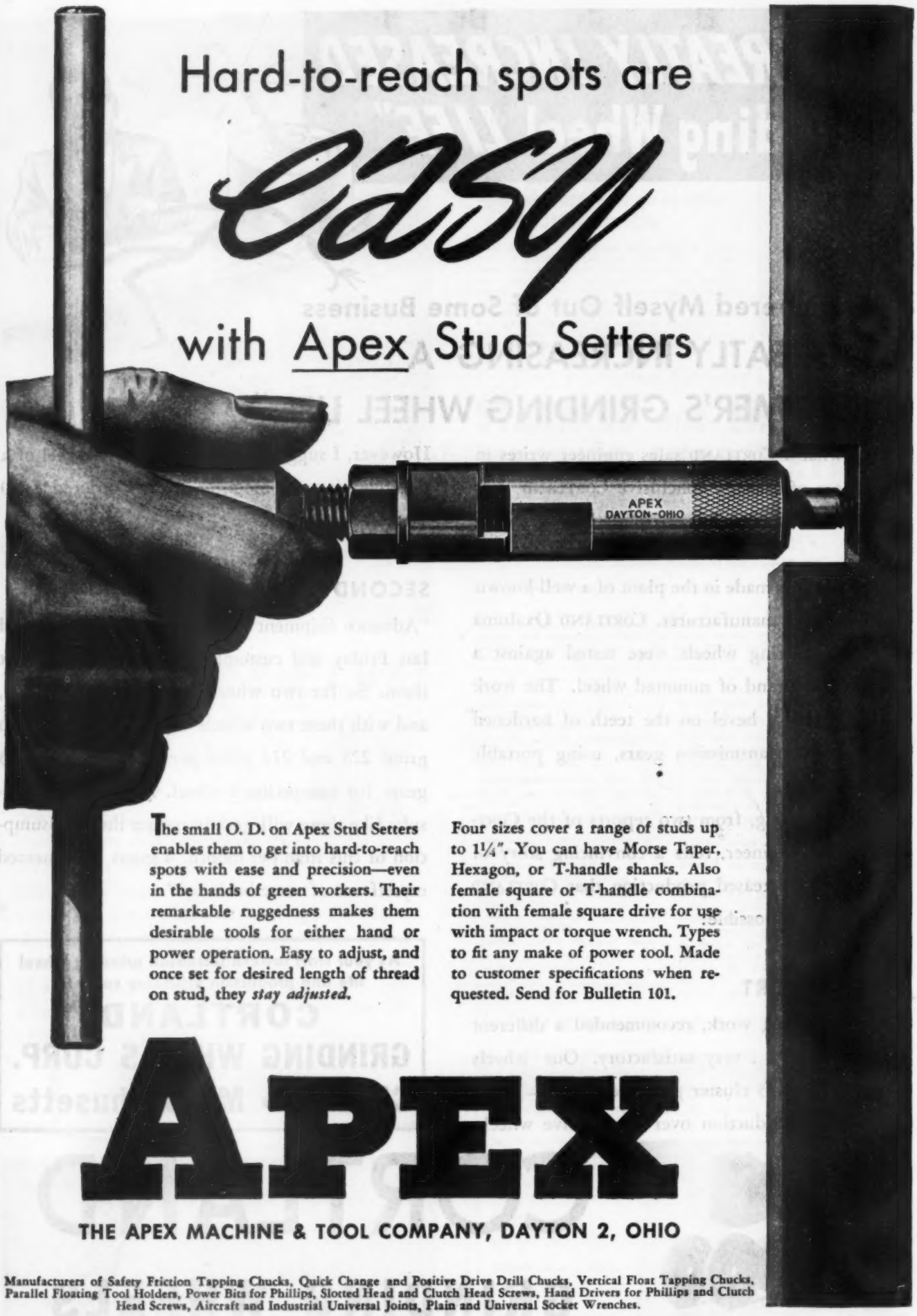

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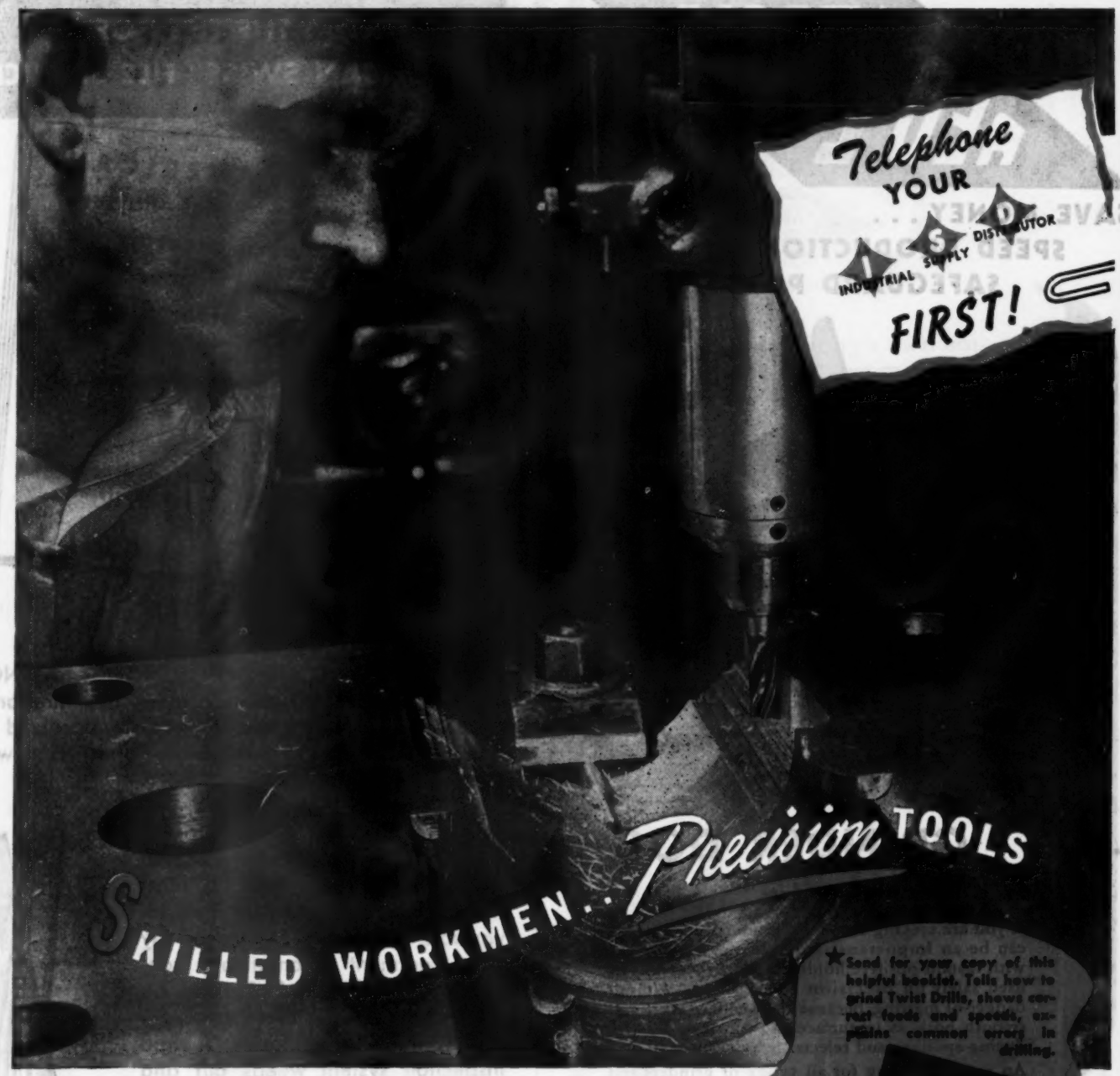

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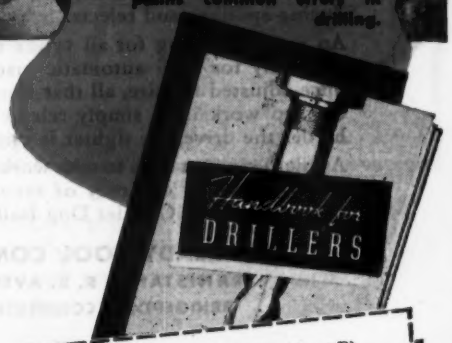

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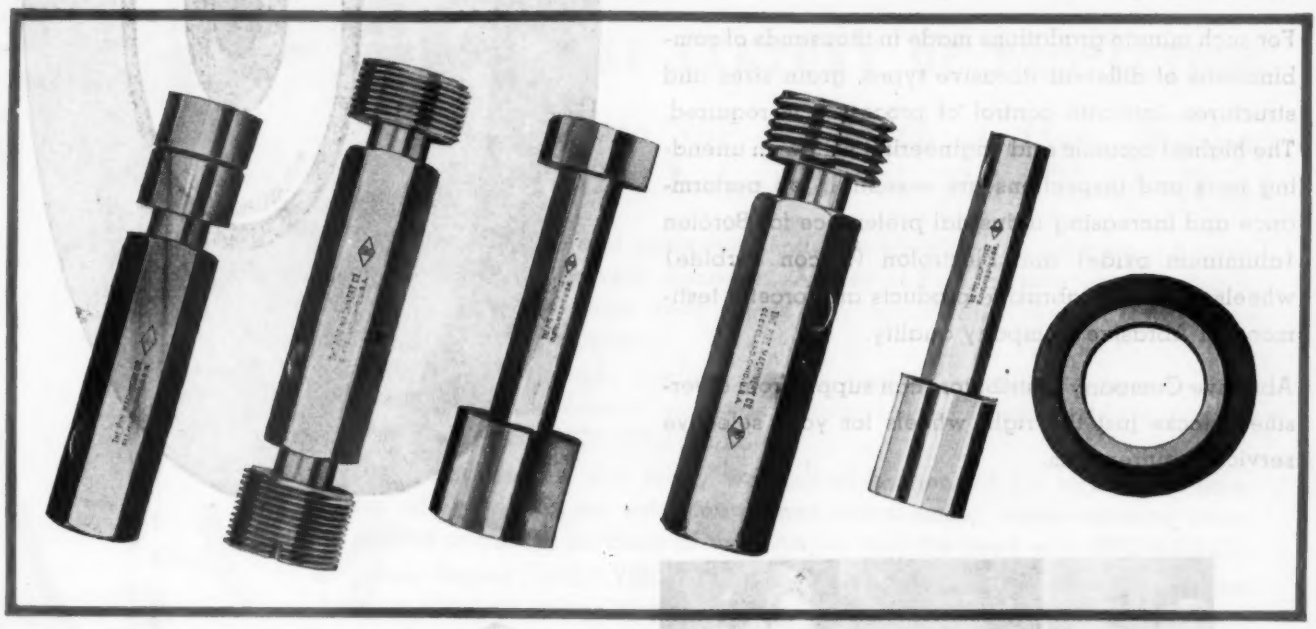

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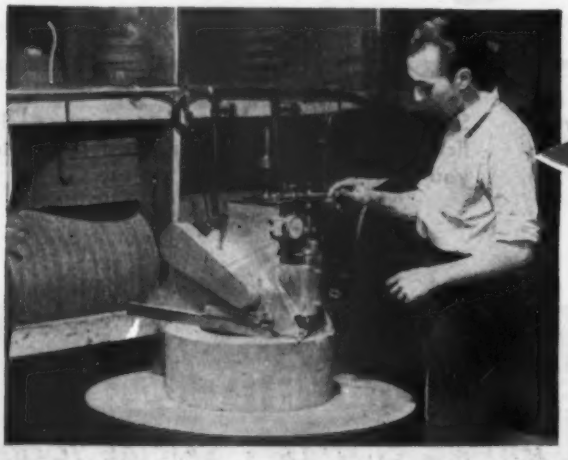
It takes all of 23 letters of the alphabet to designate all the grades of hardness which are available in Borolon and Electrolon Grinding Wheels. But, this wide range of grades from "very soft" to "very hard" is necessary to enable Abrasive Company to meet the very diversified requirements of industry for grinding every type of material on every kind of machine, at varying speeds, for every type of grinding from snagging to fine finishing.

For such minute gradations made in thousands of combinations of different abrasive types, grain sizes and structures, intricate control of processes is required. The highest ceramic and engineering skill with unending tests and inspections are essential. Job performance and increasing industrial preference for Borolon (aluminum oxide) and Electrolon (silicon carbide) wheels and other abrasive products are forceful testimony of Abrasive Company quality.

Abrasive Company Distributors can supply from diversified stocks just the right wheels for your selective service requirements.



abrasive Company

Division Simonds Saw and Steel Company

The correct grade of hardness in every Borolon and Electrolon Grinding Wheel is assured by various check tests with special equipment.

ABRASIVE COMPANY, PHILADELPHIA • DISTRIBUTORS IN ALL PRINCIPAL CITIES

Angier
OF FRAMINGHAM

50th Anniversary
1895 - 1945

A HALF CENTURY OF PROTECTION

. . . to the Products of Our Nation and its Industries in Peace and War

Airplane engine and parts manufacturers were up against it for a grease-proof wrapper to prevent corrosion. Angier of Framingham produced it in INDUWRAP, which more than meets any specification ever drawn for a Grade A, Type I wrapper.

Chrysler of Canada engines were in trouble because of damage from the elements while enroute overseas. Angier helped to eliminate this trouble with A-19 BROWNSKIN GRIZZLYBEAR.

The government and many war industries needed for tarpaulins, case-liners and wrappers an extra-tough, non-deteriorating, water-resisting paper to protect countless products of war. Angier met the need with BROWNSKIN.

And Angier GRIZZLYBEAR, in both the asphalt and resinous grades, has been a constant solver of problems confronting shippers of airplane motors and critical wire, much of the latter in spirally-wrapped coils.

Have you an essential problem in product protection? Put it up to Angier engineers.

ASK FOR LITERATURE AND SAMPLES

Please mention by name this magazine

ANGIER CORPORATION

CORROSION PREVENTIVE AND WATERPROOF PAPERS

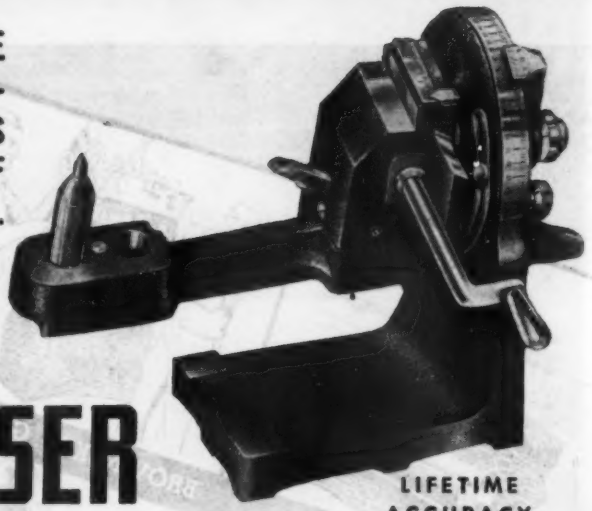
FRAMINGHAM, MASSACHUSETTS

Angier

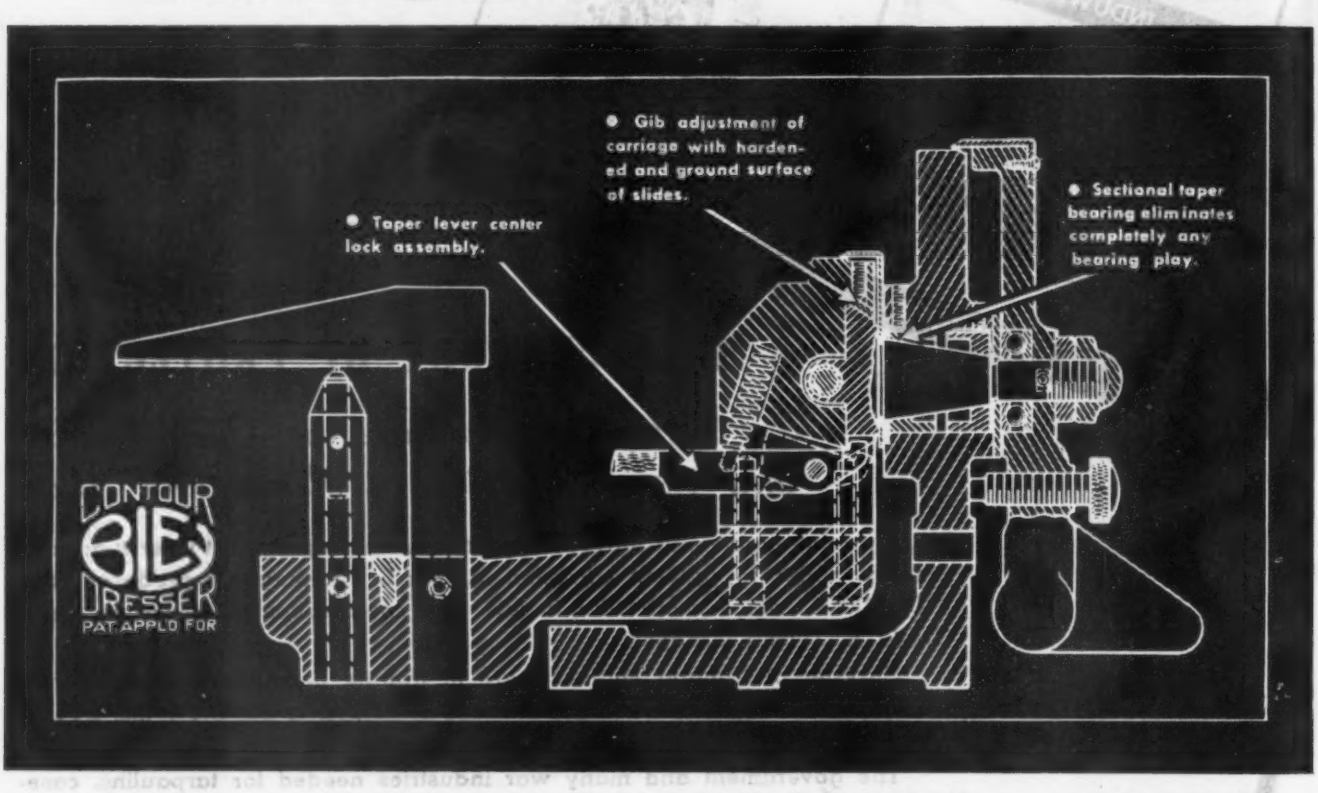
● FOR ABSOLUTE PRECISION IN THE FORMING OF GRINDING WHEELS: ANGLES, RADII AND THEIR COMBINATIONS AND PERFECT BLENDING OF RADII WITH TANGENTS . . .

Bley CONTOUR DRESSER

FOR SHAPING GRINDING WHEELS



LIFETIME ACCURACY GUARANTEED


● Gib adjustment of carriage with hardened and ground surface of slides.
● Taper lever center lock assembly.
● Sectional taper bearing eliminates completely any bearing play.
CONTOUR
BLEY
DRESSER
PAT. APPLD FOR

Operates on a totally new and different principle! . . . Guarantees absolute precision and accuracy throughout the life of the fixture! Priced to meet the needs of the small shop—and so that purchase of several is practical for the larger shop.

1 Precision is guaranteed for the life of the fixture. Guaranteed accuracy of repeated redressing of grinding wheels at a tolerance of less than .0005.

2 Even the most complicated "setup" can be made right on the bench.

Capacity: grinding wheels up to 14" in dimater, 3" male and 3" female radii. Total of 2" lineal travel for angular work. Tangents: 1" on either side of radius.

BLEY CONTOUR DRESSER

WITH 9 DIAMOND TOOLS

90° GOLCONE shaped point	$ 3.50
60° GOLCONE shaped point	4.00
CRYSTAL point	3.50
ELONGATED natural point	5.00
Rattail Tools For Semi-Circular Radii	
1/2" Rattail, radii from 0.250"	$ 7.50
1/4" Rattail, radii from 0.125"	7.50
1/8" Rattail, radii from 0.060"	5.00
5/32" Rattail, radii from 0.040"	7.25
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6 EXTENSION SLEEVES and 1 RATTAIL TOOL ATTACHMENT

ALL FITTED IN FINE HINGED WOOD INSTRUMENT CASE

PRICED COMPLETE

$207.50

Est. 1925

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Crack Down on Down-Time!

CHANGE TO

TECO CEMENTED CARBIDE

AND GET

- More pieces between grinds
- More grinds per tool
- Less down time
- Lower tool cost

You can reduce your present down-time—and save production, costs and manpower—by tooling up with longer-wearing TECO Cemented Carbide.

TECO Cemented Carbide produces more pieces between grinds because intense hardness gives it greater resistance to wear, while controlled toughness and uniformity make it more resistant to breakage. Result: Teco Cemented Carbide stays on the job longer—causes fewer machine stoppages due to dull tool edges or broken tips.

Check these properties of TECO Cemented Carbide against your present cutting tools . . . on your own lathes, under your own conditions. Send us details of your operation. Or have a tool engineer discuss your needs. Catalog and price list on request.

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CEMENTED CARBIDE
Pioneers in Tungsten Carbides for over a Quarter Century

Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
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PLANNING FOR RECONVERSION ?

Then you'll want this "KIT OF FACTS"

on

BETHLEHEM'S BIG 8 TOOL STEELS

Reconversion talk is in the air. Talk of retooling—and that will mean thousands and thousands of jobs for the Big 8 Tool Steels.

The Big 8 are probably old friends of yours. But in planning for reconversion, you'll want information that will be useful during the change-over period.

You can get it by writing for the Big 8 "kit"—eight individual booklets crammed with basic facts on these versatile tool steels. For your convenience, the booklets are mailed as a set in a durable, handsome container; one you'll be glad to keep on your desk.

Bethlehem's Big 8 are suitable for more than 90 per cent of your tool-steel jobs. You'll find many of these jobs listed in the eight booklets—together with a wealth of facts on other pertinent items. Ask for your set *today*.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Bethlehem Steel Export Corporation, New York City

★ BETHLEHEM STEEL ★

FREE

A request on your company letterhead brings you the kit post-haste. Here's what you'll find inside:

Uses of each steel

Instructions for heat-treating

Analyses

Discussions of critical points, hardening, impact tests, etc.

Graphs of tensile properties

Tables, micrographs, and other illustrations

Carbon Tool Steel
(water-hardening)

Tool Room (BTR)
(oil-hardening)

Omega
(maximum shock-resistance, cold work)

No. 67 Chisel
(high shock-resistance, both hot and cold work)

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(low distortion during heat-treatment)

Lehigh Die & Tool, H Temper
(high-production die steel)

No. 57 Hot Work
(maximum red-hardness in hot work)

No. 66 High Speed
(general-purpose high-speed steel)

THE RIGHT TOOLS

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Drills • Counterbores
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Whatever your metal cutting problem, there is a National tool to do the job. National makes a complete range of high speed twist drills, reamers, counterbores, and end mills—as well as hobs and milling cutters. Every tool is designed and built to give uniform high performance and long life under hard usage.

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TWIST DRILLS
REAMERS, HOBS
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SPECIAL TOOLS

TWIST DRILL AND TOOL COMPANY

DETROIT AND ROCHESTER, MICHIGAN

Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

FOR RECONVERSION RUST

WHETHER reconversion of your plant to peacetime production is sudden or gradual, one of your first chores will have to be the rustproofing and processing of Government-owned machinery, tools and other production equipment scheduled to go into storage. This must be done, *with minimum delay,* in accordance with Ordnance Instruction P.S. 300-4.

A stock of suitable Texaco rustproofing products on hand will greatly facilitate your compliance with this requirement, and speed your changeover to civilian production.

Texaco rustproofing products meet Ordnance specifications, and are easily applied by brush, dip or spray. The

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT —CBS

TEXACO

PROOFING

protective coating they provide will assure preservation for years.

Whatever your rustproofing requirements, a Texaco representative can render helpful service. Get in touch with the nearest of more than 2300 Texaco distributing plants in the 48 States, or write to The Texas Company, 135 East 42nd Street, New York 17, N.Y.

REMEMBER...

1. Upon termination of war contracts, Government-owned production equipment must be rustproofed promptly, in accordance with official instructions.

2. Ordnance Specification P.S. 300-4 contains official instructions for the complete processing of such equipment.

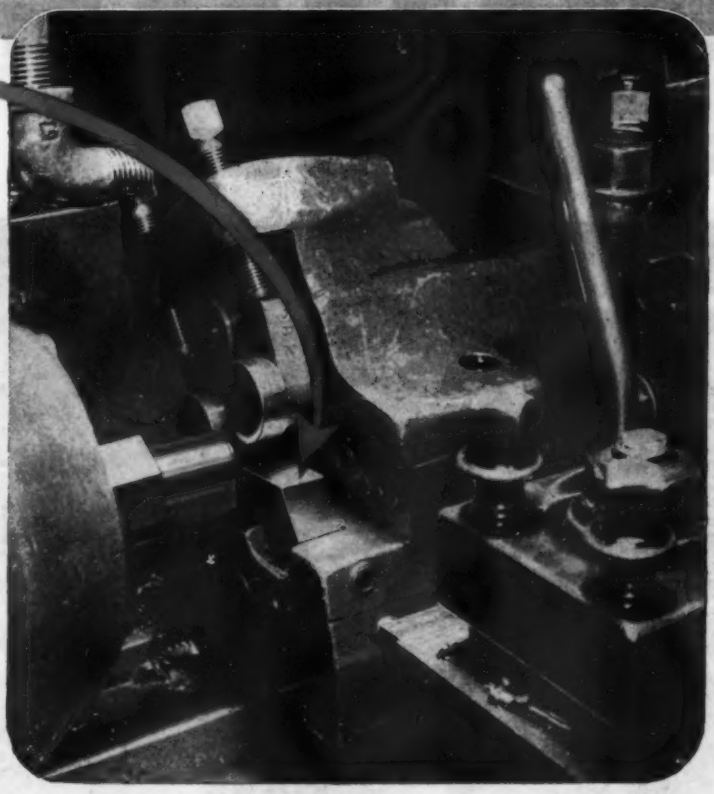
3. These instructions require that only rustproofing materials meeting Government specifications be used.

4. Texaco rustproofing products meet Ordnance specifications for application on Government-owned equipment.

Rustproofing Products

"HARDSTEEL"

Tool Bits



DOUBLE SPEED of turning SAE 4130 hex bolts and MULTIPLY BY 16 the output between grinds

Top illustration shows tool in withdrawn position after completing cut. The actual cutting is shown directly above. Inset shows the finished bolt.

● Another tough production problem solved by "HARDSTEEL"! To make the bolt illustrated, ⅞" hex stock had to be turned to ⅜" diameter round. The inherent toughness of the SAE 4130 steel plus an intermittent cut at the start of the turning operation gave low production with tools of high speed steel.

When the manufacturer switched to "HARDSTEEL" tool bits, ground with 7° clearance angle, 9° back rake and 10° side rake, speed and feed were stepped-up, cutting turning time in half. Production was further increased because the "HARDSTEEL" tools held their edge and required re-grinding only once every 20 hours!

"HARDSTEEL" Drills, Tool Bits and Special Tools are solving many production problems—among them drilling hardened steels and machining tough, hard steels and abrasive alloys. Write for your free copy of the "HARDSTEEL" Operator's Manual.

Also inquire about "HARDSTEEL" as a metal for special parts that must meet unusual conditions of service.

"HARDSTEEL"

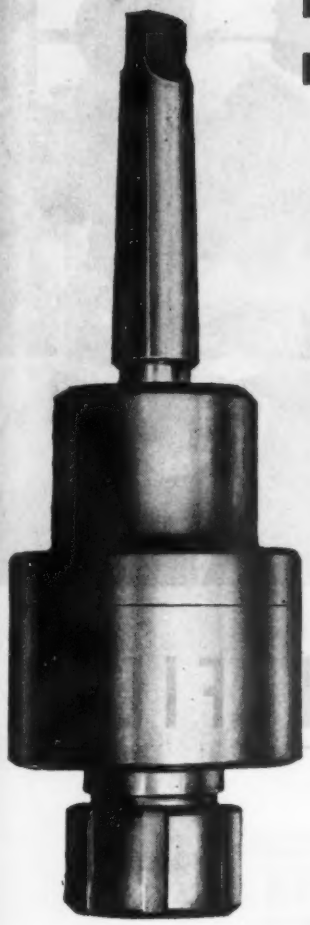
DRILLS • TOOL BITS • SPECIALS

BLACK DRILL CO. • Division of Black Industries • 1400 E. 222nd St., Cleveland, 17, Ohio

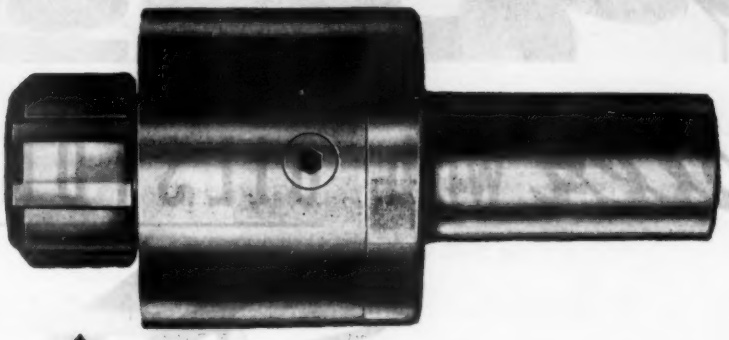
Other Divisions: Black Boring and Machine Co. Mac-Rod Division

Announcing!

NEW DESIGN OF UNIVERSAL FLOATING CHUCKS FOR BETTER BALANCE, EASIER CENTERING, SAVING IN TIME



Two great advantages result from the new design of the Universal Floating Chuck. First, when the chuck is used in a horizontal position, a quick adjustment made through the flat springs counter-balances tool weight. Hence, chuck nose and tool can be brought to within a few thousandths of the center of work at high speed, saving considerable time. This quick adjustment is accomplished without restricting the floating action of the chuck. Since the frictionless bearings are radially ground in an interlocking assembly to carry both the driving and thrust load, there are no auxiliary bearings to increase friction or resistance. The second big advantage of the new Universal chuck is the seal which positively prevents the entrance of coolant into the assembly without restricting the floating action of the chuck. This means the chuck can be used at high speeds and heavy feeds where the use of coolant is required, without harming the efficiency of the mechanism. For counter drilling, reaming and counterboring round, straight, smooth holes, use the new Universal Floating Chuck—positively the most sensitive float on the market today. Write for complete information.



↑ FOR HORIZONTAL OPERATION

← FOR VERTICAL OPERATION

UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND ACCURACY IN YOUR PLANT

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH, MICHIGAN — Fighter Plane Given by Employees — Employee Bond Deductions

Easier with OILSTONE FILES

OILSTONE files are abrasive files and they're *all* file, not just rows of cut teeth. But their main utility in production and rework finishing of machined parts lies in their ability to perform light, offhand stock removal operations after machining, but within the original tolerance limits.

Whether on revolving work or stationary bench pieces, the hard, sharp abrasive crystals in oilstone files, shaped for conformity to work contours, quickly but delicately remove burrs and sharp edges, refine radii and bevels, or eliminate the binding of mated parts.

India (Alumium Oxide, oil filled) and Hard Arkansas (natural abrasive) Files offer Industry a complete size and shape range of over a hundred items with a finish spread from coarse, medium and fine India to the surgical fineness of Hard Arkansas.

Ask your Behr-Manning Field Engineer or your friendly distributor salesman about Norton Abrasive Oilstone Files. New color chart, "Industry Oilstones," available on request.

Maximum CUT — Minimum COST — QUALITY ABRASIVES

BEHR-MANNING · TROY, N. Y.

(DIVISION OF NORTON COMPANY)

ALSO QUALITY SANDPAPERS SINCE 1872

Brightboy STANDARD

A favorite for burring, finishing and polishing on the widest variety of metals and metal parts.

* * *

Brightboy FINE-TEX

Smoother, finer texture for work on softer metals, producing special finishes and for applications where the coarser wheel might not be suitable.

Brightboy TUFF-TEX

Tougher texture, for finishing hard metals. The tougher binder accents the abrasive action yet retains the soft rubber cushion, finishing and pre-polishing in one operation.

A Revelation In Metal Finishing

RUBBER-CUSHIONED

WELDON ROBERTS

Brightboy

Reg. U.S. Pat. Off.

EVENTUAL production change-over from war goods to much-needed industrial and consumer commodities presents wide, work-saving, product-improving opportunities through Brightboy rubber-cushioned metal finishing.

Brightboy's resilient rubber binder *rubs* and *cleans*. At the sae time, it combines with and cushions the abrasive in an all-in-one, close-tolerance burring and finishing action. In countless applications, a Brightboy finish serves as the final polish.

With new manufacturing opportunities on the horizon, you should investigate Brightboy, the proved pioneer in rubber cushioned abrasives. Ask your distributor about Brightboy; get prices, catalogs, work data. And contact Brightboy service representatives on your production planning or on any metal finishing problem.

A COMPLETE LINE IN THREE TEXTURES FOR MANUAL & MACHINE OPERATION

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark 7, N. J.

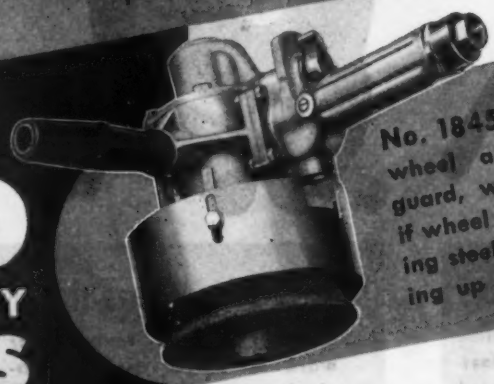
WELDON ROBERTS

Brightboy

No. 1460, fitted with pad for abrasive discs. So made it is widely used in auto body and metal furniture plants.

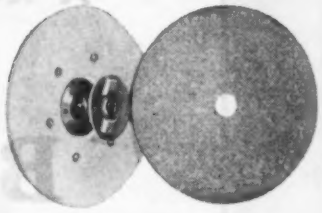
CLECO
VERTICAL ROTARY GRINDERS

FOR: ✓ grinding
✓ polishing
✓ brushing
✓ removing rust, paint, scale, etc.



No. 1845 fitted with abrasive wheel and adjustable wheel guard, which protects operator if wheel breaks. Used for surfacing steel sheets and bars, cleaning up welding operations, etc.

No. 1460, fitted with cup wire brush (supplied at extra cost) for removing rust, scale, paint from metal surfaces preparatory to repainting.



Type of flexible pad, disc holder and abrasive disc used with these Cleco Grinders.

IMPORTANT FEATURES

★ Tool automatically shuts off if governor breaks —an important safety feature.

★ Governor set so that at 80 lb. gauge pressure it holds grinder safely at its most effective speed.

★ Rugged rotors, heat treated and ground to exact size, insure vibration free operation.

★ Air is admitted under *each* blade throughout its power sector—immediate starting even under load.

★ Efficient lubrication system increases tool life.

SPECIFICATIONS

No.	Speed	Weight	Capacity Diam. of Flexible Pad	Diameter Elastic Bonded Cup Wheel
1845	4300 R.P.M.	12 lbs.	9″	6″
1860	5800 R.P.M.	12 lbs.	9″	
1460	5800 R.P.M.	8¼ lbs.	7″	4″
1480	8000 R.P.M.	8¼ lbs.	7″	4″

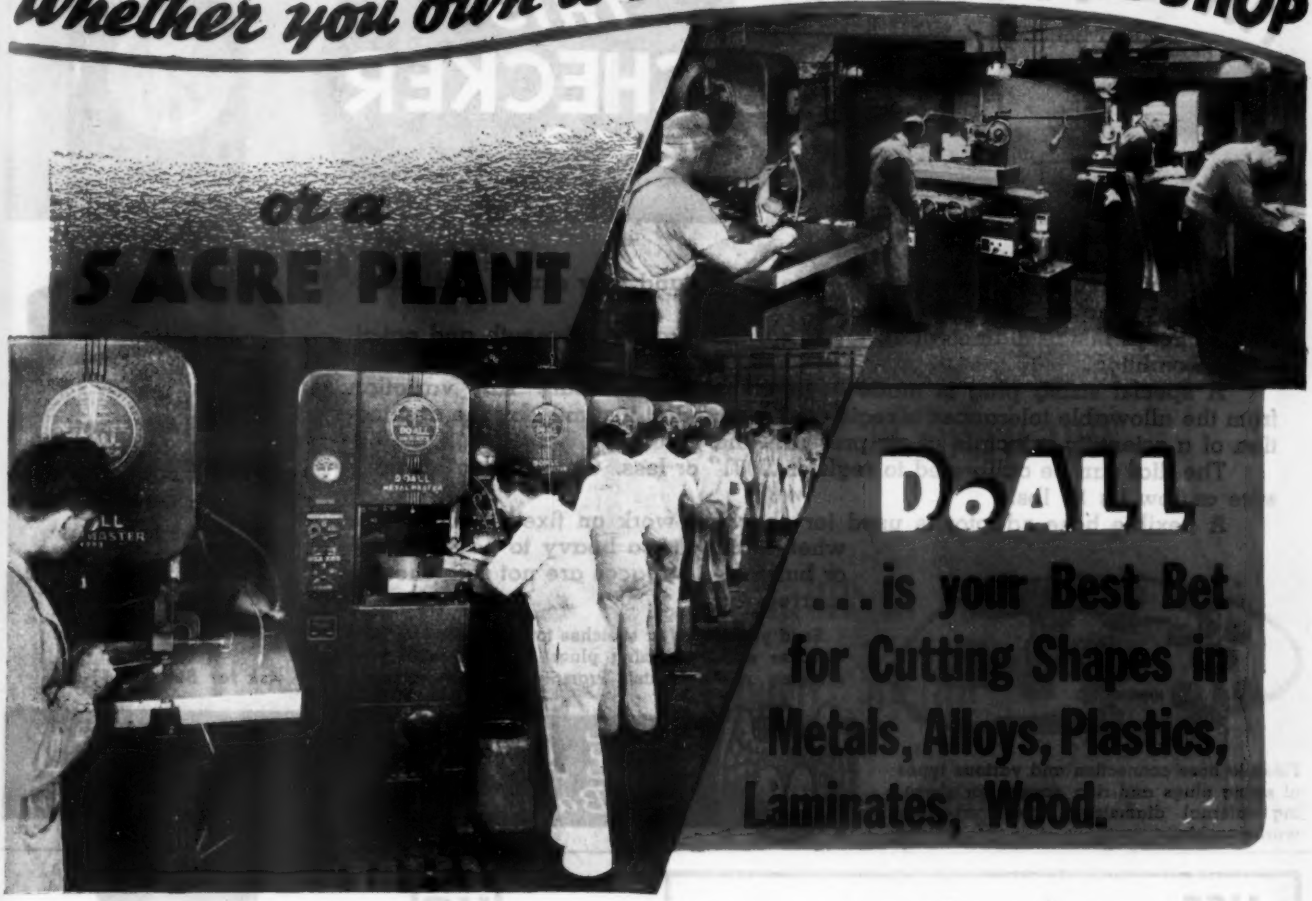
Write for Bulletin 80!

THE CLEVELAND PNEUMATIC TOOL COMPANY

3781 EAST 77th STREET **CLEVELAND 5, OHIO**

Branch Offices in Principal Cities

Whether you own a 1-ROOM MACHINE SHOP or a 5 ACRE PLANT



Hundreds of short cuts—bottlenecks eliminated—thousands of man hours saved every week—it's easy when you make full use of the DoALL.

Cut a special wrench out of bar stock, a die from a 10" block, a replacement part for some crippled machine, 50 to 100 shapes from stacked sheets, or other production work.

The DoALL does internal and external cutting—accommodates a whole series of narrow, hard-toothed band saws to cut any kind of material quickly and so smoothly that finish machining is rarely necessary.

Six models available, each equipped with Variable Speed Control, Job Selector showing the proper saw to use for each material, and motors—all set up, ready to operate.

Learn more about the DoALL, which soon pays for itself in time and metal savings. Send for illustrated literature today.

INDUSTRY'S NEW SET OF TOOLS

Contour Sawing · Band Filer · Surface Grinders · Magnetic Chucks and Selectron · Colloidal Oils · Dust Collector · Gage Blocks with Instruments

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Boston	ASP 6669	Denver	KE 7511								
Buffalo	PA 6666	Detroit	TE 2-3060								
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The DoALL Company — Minneapolis 4, Minnesota

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HAVE YOU SEEN THIS HOLE CHECKER WORK?

YOU really have to see it in operation to understand how simple and adaptable it is; yet how rapid and accurate.

It checks inside diameters up to 24" for size, taper, bell-mouth and out-of-round condition.

A special sizing plug is made to fit the production part. Any variation from the allowable tolerances is registered on the dial instantly by the application of a scientific principle of air pressure and volume.

The dial can be calibrated to register .0001" or less. Operates on air pressure as low as 50 lbs.

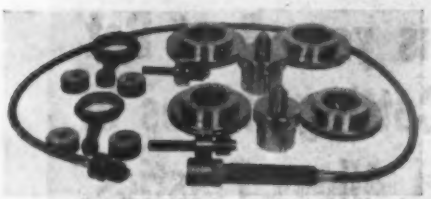
A flexible hose adaptor is used for checking work on fixed machines or where work is too heavy to handle. Soft or burnished surfaces are not scratched or marred.

Send your prints or sketches for quotations on Hole Checker unit and sizing plugs made to meet your gauging requirements. Prompt deliveries assured.

OTHER AMERICAN PRECISION PRODUCTS

Amplifying Gauges
Thread Checkers
Bench Centers
Radius Dressers
Lapping Plates

Ask for Bulletin 43-MT.



Flexible hose connection and various types of sizing plugs and ring gauges for checking internal diameters. Finest precision workmanship.

THE AMERICAN GAUGE CO.
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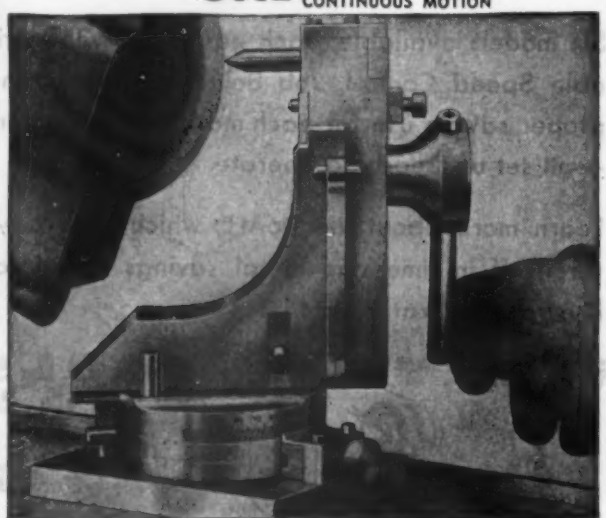
USE *Fluid-motion* for modern form-dressing

ONE SETTING HANDLE CONTINUOUS MOTION



The J & S Model "E" Radii & Angle Dresser in the new "Fluid-motion" series is one of the finest precision dressing instruments procurable—regardless of cost.

FEATURES

Fluid-motion dressing.
.0001" accuracy.
Automatic centering.
Chatterless and dustproof.
14" wheel capacity.
Versatile and adaptable.

J. & S. TOOL CO.
477 MAIN STREET
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STANDARD US HEADS SINCE 1915

All Types of Fixed Center

DRILLING TAPPING & BORING HEADS

Four Spindle Head. All Spindles Adjustable for equally spaced holes.

FIVE TYPES, 56 SIZES, ADJUSTABLE DRILL HEADS

UNITED STATES DRILL HEAD CO., CINCINNATI 4, OHIO

GRINDING WHEEL DRESSER

Diamond Cutter

Diamond Nut Dresser

We manufacture a complete line of Dressers and Cutters. Write for copy of catalog "A".

DESMOND-STEPHAN MFG. CO.
URBANA, OHIO
Canadian D-S Mfg. Co., Hamilton, Ont.

ARMY (E) NAVY

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

New spindle oils have these operating advantages

- Reduce gummy deposits at high speeds
- Eliminate bothersome blending of lubricants
- Available in correct viscosity grade for your equipment

High speed spindle lubrication has been a serious problem in many plants. In some, continuous operation required on war production has caused excessive gummy or varnish deposits on spindles, which had to be cleaned frequently. Blending of certain oils with kerosene to get the right viscosity has been troublesome.

Working with some of these war plants, Standard Oil developed special spindle lubricants. To prevent gum formation, they were stabilized against oxidation. Blending in the plant was eliminated. Various grades were produced to meet machine manufacturers' needs. In short, these oils were tested and found far superior for all types of high speed spindles.

SUPERLA SPINDLE OILS

Superla Spindle Oil is now available to all plants. Let a Standard Oil Lubrication Engineer help you test it on some troublesome application in your plant. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

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LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

What qualities to look for in cost-saving greases

QUALITIES that reduce wear on bearings and gears . . . that stop excessive consumption . . . that cut oiler time for servicing equipment . . . these are the qualities you want in a grease. What they are and how you can get them is described in a booklet illustrated at right.

Many of the advantages, which you would expect to find only in special purpose, premium priced greases, are available in a line of 11 grades—including high-temperature greases—called

SUPERLA GREASES

Send for this Booklet

It tells how the most desirable qualities have been incorporated in a complete line of grease to reduce costs on a wide range of Industrial application.

It also has hints on hand packing anti-friction bearings and avoiding over-lubrication.

You can get a copy from the Standard Oil Industrial Service Representative who calls on you or by writing Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

when your tool needs are

Served By METRO..

. . . you will find, as many another manufacturer has, that Metro Carbide Tools and Gages meet the highest standard of present-day production, because Metro Carbide Tipped Tools and Metro Precision Gages are engineered to the highest standard of accuracy by Metro experience and Metro craftsmanship.

No matter what your requirements are—standard or special tools and gages—a consultation with Metro will tell you much.

Send now for Catalog No. 103

ARMY E NAVY

METRO TOOL AND GAGE CO.

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American Machinist Chips

The 1945 Inventory of Metal-Working Equipment, featured in the July 5 issue, brings you the latest and most authentic picture of our manufacturing facilities.

Particularly interesting is the revelation that 38% of all metal-working equipment installed in American industry is over 10 years old. Discussion of this and many other significant facts will make absorbing reading for all shop men.

As in former years, the Inventory is being reprinted—complete with the large table of figures detailing the 2,799,532 units of shop equipment identified.

These reprints are priced at $1.00 each and are available to readers who may wish one or more extra copies of this study.

When you have had a chance to go over the 1945 Inventory, we would appreciate receiving your comments.

HAVE YOU ORDERED YOUR COPY?

AMERICAN MACHINIST
330 West 42d St., New York 18, N. Y.

Please send me, at $1.00 each, ( ) copies of the reprint of your 1945 Inventory of Metal-Working Equipment

NAME .....

POSITION .....

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FILL OUT COUPON AND MAIL TODAY

How a 40-dollar ELGIN Sapphire Gage saved Stewart-Warner $4,000 PLUS!

Still showing less than .00001 inch wear, well within tolerance limits, an Elgin Sapphire Plug Gage has delivered the incredible total of 158,220 close tolerances gagings! Hi-speed *steel* gages, formerly used, wore beyond tolerance use after only 300 gagings! The startling contrast in *gage* cost for 158,220 gagings is shown below:

Gage	Gages required	Cost	Total Cost
Steel	527	$8.00 ea.	$4,216.00
Elgin	1	40.00 ea.	40.00
		SAVINGS—	$4,176.00

This tremendous saving is only for *one* of many gages on this job at Stewart-Warner—many Elgin Sapphire Gages are in continuous use at the plant.

The dimensional fidelity of Elgin Gages saves money, too, by *eliminating* worn-gage rejects. Chemically inert at normal temperatures, their contact points of sapphire do not rust, corrode, burr or become distorted with use.

Write for prices and information on Elgin Sapphire Plug and Ring Gages.

ELGIN SAPPHIRE PRODUCTS PRESENT MANY ADVANTAGES FOR THE FOLLOWING TYPES OF EQUIPMENT:

Gages • Bearings • Thread Guides • Extrusion Dies • Knife Edges • Spray Nozzles • Diesel Injector Nozzles • Soft Wire Dies • Burnishing Tools • Pressure Vessel Windows • Watch Crystals • Honing Stones.

America's best equipped sapphire fabricator

ELGIN NATIONAL WATCH COMPANY

Sapphire Products Division

★ 932 Benton Street, Aurora, Illinois, U. S. A. ★

AUTOMATIC

- STOCK FEED
- CLAMPING
- WHEEL FEED
- ADJUSTMENT FOR WHEEL WEAR
- EJECTION

...AND HERE'S A TYPICAL JOB

• To finish cut rollers for bearings from 52/100 bar stock to close tolerances. Former method required grinding ends. With this new Model 700 AUTOCUTTER the job is done automatically, one operator running a number of machines. No grinding is necessary.

This line of fully automatic abrasive cutting machines is the solution to many problems of production cutting of short pieces with finished ends and to close tolerances. Model 700 cuts up to ¾" stock—Model 725 up to 2½".

IF YOU HAVE A CUTTING PROBLEM

Write and tell us (1) the range of sizes, (2) kind of material, (3) length of cutoff pieces, (4) length of stock before cutting, (5) tolerance for length of cut pieces and (6) hourly production requirement. With this information, **CAMPBELL** engineers can recommend production procedure and work up cost sheets for you.

Campbell

ABRASIVE CUTTING MACHINES

ACCO

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE
BRIDGEPORT, CONN.

TRADE MARK

ANOTHER PRODUCTION SHORT-CUT WITH 'SURFACE'

Standard Rated ATMOSPHERE HARDENING FURNACES

STANDARD RATED
PREDETERMINED Size · Capacity · Fuel Consumption
ANOTHER EXCLUSIVE 'Surface' Feature

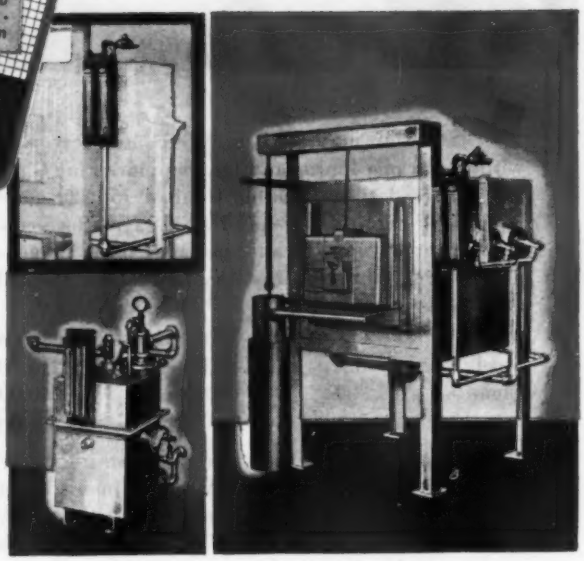
Twenty thousand cargo tie-down bolts hardened without a reject! Unusual—no, it's an everyday occurrence in a 'Surface' equipped shop.

But—the fact that a Char-Mo user cut another operation to the minimum, should interest you from the standpoint of postwar production costs. Formerly these bolts were machined with .015"–.020" material left on thread before hardening. After heat treatment it was necessary to run over all threads with a hand die.

Since these pieces have been hardened in a Standard Rated Char-Mo Atmosphere furnace—bolts are machined to *final dimension* before heat treatment.

Result—no rejects—production costs cut—expensive die costs materially reduced—no machining or cutting of final hardened pieces. Another production short-cut via 'Surface' Standard Rated Atmosphere Furnaces.

Ask for bulletin CG-43 describing this equipment.



CHAR-MO FURNACES: Atmosphere generator is an integral part of the furnace. Char-Mo atmosphere (⅓ CO, ⅔ Nitrogen) prevents scaling and decarburization of practically all steels.

MUFFLE FURNACES: Are equipped with gas tight muffles to prevent products of combustion from contacting metal surfaces during heat treatment. Any required atmosphere can be introduced into the muffle of this type furnace.

ATMOSPHERE GENERATORS—MDX: Generator provides a burned gas, water cooled atmosphere which protects low carbon steels and non ferrous metals against surface deterioration.

AG Mixers provide a cracked gas atmosphere which is protective to higher carbon steels.

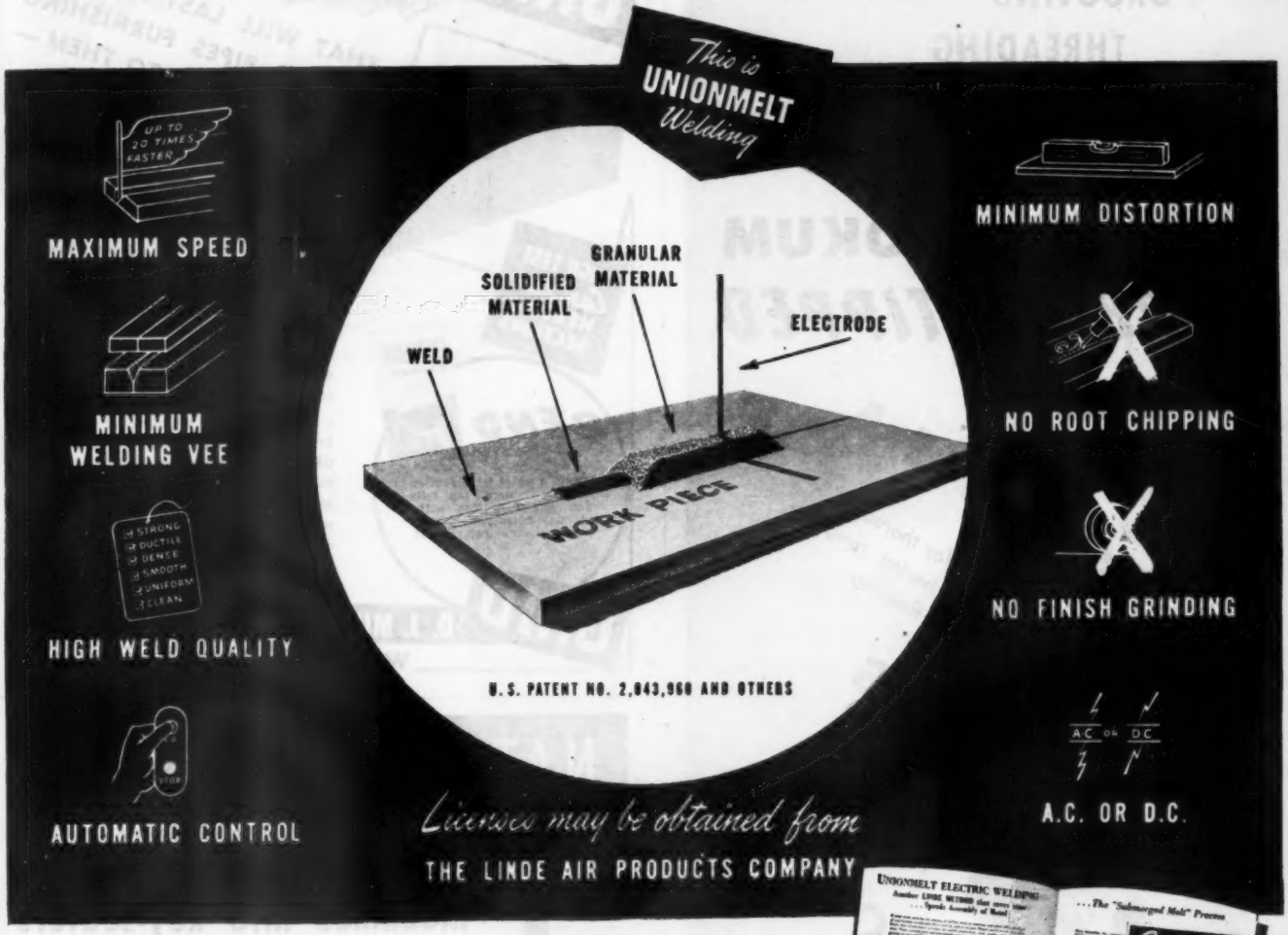
'Surface'

SURFACE COMBUSTION CORPORATION · TOLEDO 1, OHIO

STANDARD AND SPECIAL INDUSTRIAL FURNACE EQUIPMENT FOR:
Forging, Normalizing, Annealing, Hardening, Drawing (Direct-fired and Convection), Carburizing, Nitriding and Heating. Special Atmosphere Generators.
Write for bulletins.

These are the advantages of Automatic UNIONMELT Electric Welding

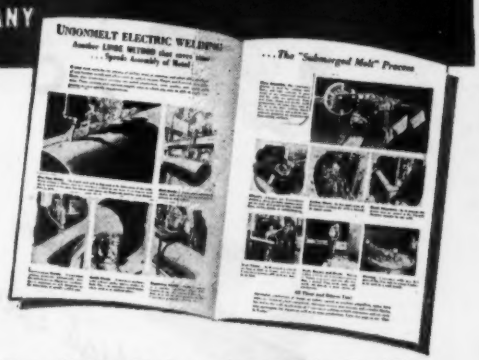
A PROCESS OF WELDING ELECTRICALLY BENEATH A MINERAL MELT



Hundreds of manufacturers are now benefiting by the advantages of UNIONMELT Welding. It gives them top quality welds at speeds that are greater than with any other similarly applicable process.

If your work includes the joining of carbon steel, of stainless, and other alloy steels, or of non-ferrous metals and alloys such as nickel, copper, Monel, and Everdur, it is quite likely that UNIONMELT Welding can speed production, raise quality, and lower your costs.

Anyone who wishes to use this patented invention may do so under our standard license agreement. License fees are low and are based upon extent of use. Complete engineering assistance is available to licensees.



For additional information send for the folder *"Report No. 6 on the Use of Linde Methods in Mass Production"*—or ask a Linde representative to help you determine where you can use the UNIONMELT process advantageously.

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC **Offices in Other Principal Cities**

In Canada: Dominion Oxygen Company, Limited, Toronto

The word "Unionmelt" is a registered trade-mark of The Linde Air Products Company.

★ BUY UNITED STATES WAR BONDS AND STAMPS ★

BORING
BOTTOMING
FACING
GROOVING
THREADING

Made Easier

by using BOKUM *CARBIDE-TIPPED* TOOLS

use STYLE A

for thorough boring, roughing, finishing

use STYLE B

for bottoming blind holes, recessing, facing

use STYLE C

for internal threading

Same styles made in high speed steel

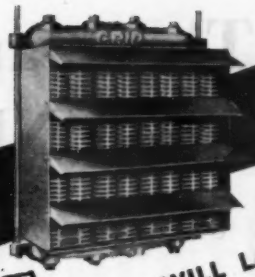
All styles sharpened only on one face

Send for catalog that shows all sizes and prices. Ask for No. K-1139 for super high speed tools and for No. K-398 for carbide tipped tools.

BOKUM TOOL CO.
14775 WILDEMERE AVE. - DETROIT 21, MICH.

INSTALL GRID UNIT HEATERS

THAT WILL LAST AS LONG AS THE PIPES FURNISHING STEAM TO THEM —



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- One piece construction heating sections (patented) of high test cast iron that withstand steam pressure up to 250 lbs.
- No soldered, brazed, welded or expanded connections to become loose or develop leaks.
- No electrolysis to cause corrosion, breakdowns, leaks, or heating failures. GRID Unit Heaters are built to last, as is proven by the many plants that have operated them continuously—some as long as 15 years, without maintenance. Complete data and capacity tables upon request.

HIGH TEST *Cast Iron* HEATING SECTIONS

SEND

New booklet "Corrosion in Unit Heaters" that tells you why cast iron withstands corrosive atmospheres—yours upon request.

GRID D. J. MURRAY MANUFACTURING CO.
WAUSAU • WISCONSIN

NATIONAL KEYSEATING MILLER

. . . the tool that converts drilling machines into key-seaters and saves time and money

- With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

The National Keyseating Miller mills, keyseats in one cut. It can be used on taper holes, offset holes, blind holes and for taper keys. Work clamping is unnecessary. We also manufacture oil-grooving millers.

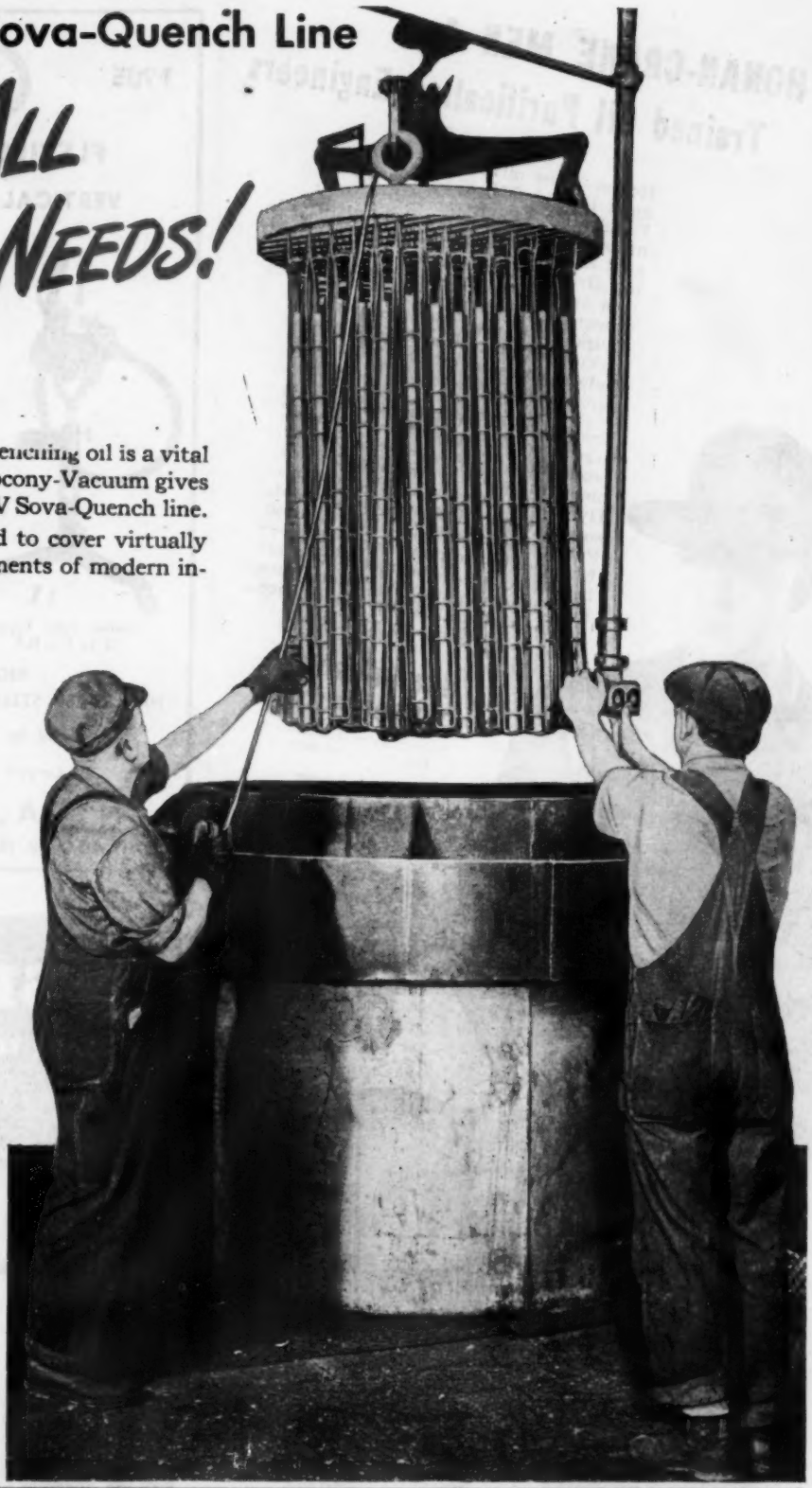
Made in twenty-six different diameters from ½" to 3½". Several widths of cutters can be used in each size.

WRITE TODAY FOR OUR NEW CATALOG NO. 15

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

This complete S/V Sova-Quench Line

MEETS ALL QUENCHING NEEDS!



CAREFUL SELECTION of the right quenching oil is a vital factor in correct heat-treating. Socony-Vacuum gives you this selection in the complete S/V Sova-Quench line.

This great line has been developed to cover virtually all the known quenching-oil requirements of modern industry. It includes:

S/V SOVA-QUENCH M,
for use in operations like the one pictured here, where moderate speeds are required and vital problems are not involved.

S/V SOVA-QUENCH D,
for moderately fast quenching where maximum resistance to oxidation and sludging is needed.

S/V SOVA-QUENCH A,
for faster quenching with good resistance to oxidation and sludging.

S/V SOVA-QUENCH R,
for exceedingly fast quenching to provide deep uniform hardness.

Let your Socony-Vacuum Representative study your quenching oil needs, and select the correct S/V Sova-Quench to give you maximum performance.

SOCONY-VACUUM OIL CO., INC.
Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California.

GARGOYLE Lubricants

SOCONY-VACUUM'S 5 Steps to Lower Production Costs:

1. Lubrication Study of Your Entire Plant
2. Lubrication Schedules and Controls
3. Lubricant Storage and Handling System
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HONAN-CRANE MEN Are Trained Oil Purification Engineers

Honan-Crane oil purification equipment is sold ONLY by trained Oil Purification Engineers—skilled technicians capable of making an intelligent analysis of any problem involving dirty or contaminated oil. These men are also capable of supervising proper installation of Honan-Crane equipment to give you maximum oil purification protection against acids, sludges, abrasives or other damaging contamination.

Keeping oil clean pays big dividends in reduced maintenance and increased production in the operation of Turbines, Internal Combustion Engines, Hydraulics, Machine Tools, Compressors and other industrial equipment. Put this Honan-Crane Oil Purification Engineer to work on your problem—he will be one of the most important men in your plant. A Honan-Crane Engineer will call at your convenience. Write today.

HONAN-CRANE CORPORATION

Subsidiary of Houdaille-Hershey Corporation

205 Wabash Avenue

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Honan-Crane has had many years of experience in the engineering and building of oil purification equipment.

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FLEXIBLE SHAFT MACHINES

VERTICAL AND HORIZONTAL TYPES
⅛ to 3 H.P.

Swivel Yoke Types
¼ to 1½ H.P.

ONE HUNDRED TWENTY-FIVE TYPES and SIZES

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HIGHEST QUALITY MACHINES
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MADE TO YOUR SPECIFICATIONS

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KNURLS

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More than 100 Standard Styles and Sizes IN STOCK. Available in either Carbon Steel or High Speed Steel.

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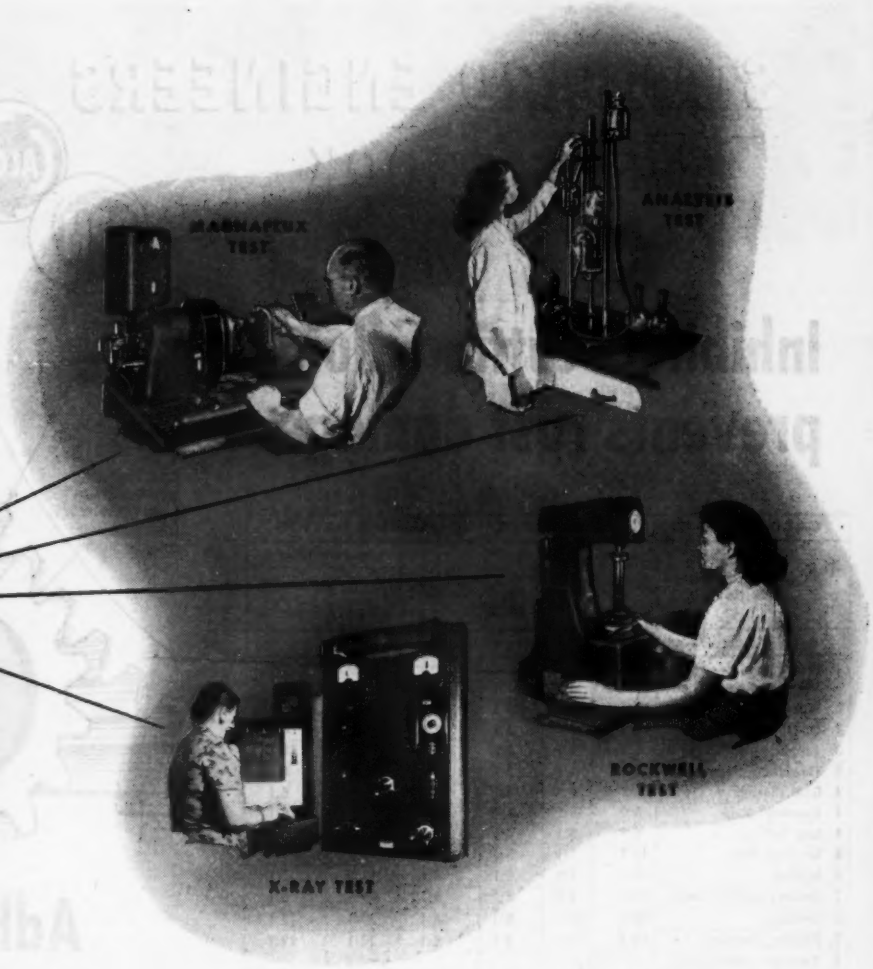
WORCESTER 2, MASSACHUSETTS



keeping a vigilant eye on BORCOLOY* quality

. . . *to bring you tools* consistently *good*

THE metal-working industry knows that **BORCOLOY** tools cut metal faster and cheaper. And — what's more important — the next **BORCOLOY** tool can be depended on to be infallibly like the last — and *for two good reasons.*

First, **BORCOLOY** tools are produced in one of the most modern cutting-tool plants in the country, under advanced, scientific methods of manufacturing control.

Secondly, each **BORCOLOY** tool is subjected — *individually* — to a series of exacting tests. Each tool is checked for uniformity of composition, for size, shape, and finish; checked again for hardness, magnafluxed and X-rayed to detect infinitesimal surface or sub-surface cracks. Every tool bearing the **BORCOLOY** name is guaranteed to be of the highest quality.

That's why you can count on *consistently* higher production between tool grinds from tools of **BORCOLOY** . . . the centrifugally-cast ferrous alloy that combines the superior hardness of heat-treated steel (up to Rockwell C-71) with the "red hardness" of cobalt and the wear- and abrasion-resistance of boron.

There's a grade of **BORCOLOY** for every machining operation in the middle-range fields:

Grade 5 — Where wear-resistance is the principal factor
Grade 6 — For maximum hardness
Grade 7 — For maximum "red hardness" on fast-cutting production jobs.

For a new idea of cutting speed and long tool life, try **BORCOLOY** tools. Distributors in your area can supply you with **BORCOLOY** tools — tipped or solid from stock.

*Registered Trade Mark

GENERAL AIRCRAFT EQUIPMENT, INC.

Tool Division; South Norwalk, Conn.

Branch Offices: Newark Detroit Los Angeles
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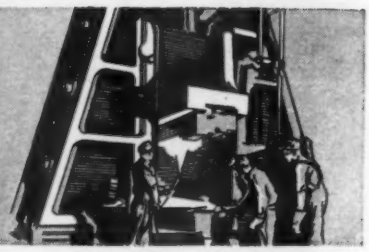
380

STANDARD ENGINEERS NOTEBOOK



Inhibited cutting fluid prevents rust damage

CALOL CUTTING CONCENTRATE—EP MIXING RATIOS

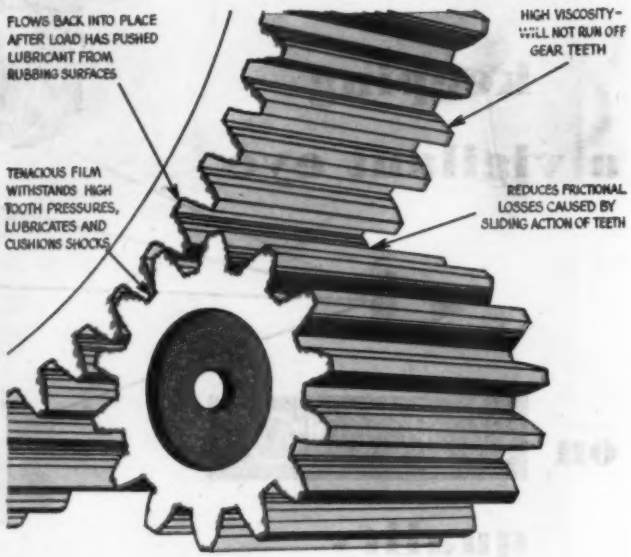
Severity	Type of Machining Operation	Ferrous Metals; Steels and Irons				Non-Ferrous Metals	
		Class I 70 Plus*	Class II 50-70*	Class III 40-50*	Class IV Below 40*	Class V 100 plus*	Class VI Below 100*
	(First figure denotes amount of diluent; the second, amount of concentrate.)						
1.	Broaching; internal (Most severe operation)	3:1	2:1	1:1	1:1	5:1	2:1
2.	Broaching; surface	5:1	4:1	3:1	2:1	5:1	4:1
2.	Threading; pipe	5:1	4:1	3:1	2:1	5:1	4:1
3.	Tapping; plain	5:1	4:1	3:1	2:1	7:1	4:1
3.	Threading; plain	5:1	4:1	3:1	2:1	7:1	4:1
4.	Gear shaving	8:1	6:1	4:1	3:1		6:1
4.	Reaming; plain	8:1	6:1	4:1	3:1	10:1	6:1
4.	Gear cutting	8:1	6:1	4:1	3:1		6:1
5.	Drilling; deep	10:1	7:1	5:1	4:1	12:1	7:1
6.	Milling	10:1	7:1	5:1	4:1	12:1	7:1
7.	Boring; multiple head	12:1	9:1	7:1	5:1	15:1	9:1
9.	Drilling	15:1	12:1	8:1	6:1	20:1	12:1
9.	Planing, shaping	15:1	12:1	8:1	6:1	20:1	12:1
9.	Turning; single point tool, form tools	15:1	12:1	8:1	6:1	20:1	12:1
10.	Sawing; circular, hack (Least severe operation)	15:1	12:1	8:1	6:1	20:1	12:1

Grinding: 1. plain—not used
2. form (thread, etc.) —not recommended.

*Machinability rating based on 100% for cold drawn Bessemer screw stock (Specification B-1112).

Protection against rust from moisture commonly absorbed by extreme-pressure-compounded cutting fluids is assured by the use of Calol Cutting Concentrate—EP. In addition to compounds giving it an unusual extreme pressure potency, Calol Cutting Concentrate—EP contains a special rust inhibitor. This inhibitor prevents moisture from corroding machine tools and work.

Calol Cutting Concentrate—EP will adequately lubricate and cool tools and work in the most severe metal-removal operations — deep tapping, blind-hole tapping, etc. It may be used undiluted, but for most operations it is blended with Calol Mineral Cutting Oil—100. Its viscosity is such that it mixes readily at ordinary temperatures. For the latest machining information, write for the free booklet, "Calol Cutting Fluids."


FLOWS BACK INTO PLACE AFTER LOAD HAS PUSHED LUBRICANT FROM RUBBING SURFACES
HIGH VISCOSITY—WILL NOT RUN OFF GEAR TEETH
TENACIOUS FILM WITHSTANDS HIGH TOOTH PRESSURES, LUBRICATES AND CUSHIONS SHOCKS
REDUCES FRICTIONAL LOSSES CAUSED BY SLIDING ACTION OF TEETH

Adhesive greases cut gear wear

Constant protection against wear, frictional loss and metal fatigue on gears may be obtained by using Calol Pinion Greases. Recommended for open and encased spur, herringbone and worm-type gears, tenacious Calol Pinion Greases will not drip off. When pushed off in use, they flow sufficiently to recover gear teeth.

Calol Pinion Grease—0. For open or encased gears, but particularly adaptable for exposed high-speed gears operating in cold weather. May be used on wire rope.

Calol Pinion Grease—1. For medium-speed exposed gears. Much heavier and slightly more adhesive than No. 0.

Calol Pinion Grease—2. For open spur gears in normal conditions. Requires some heating for application.

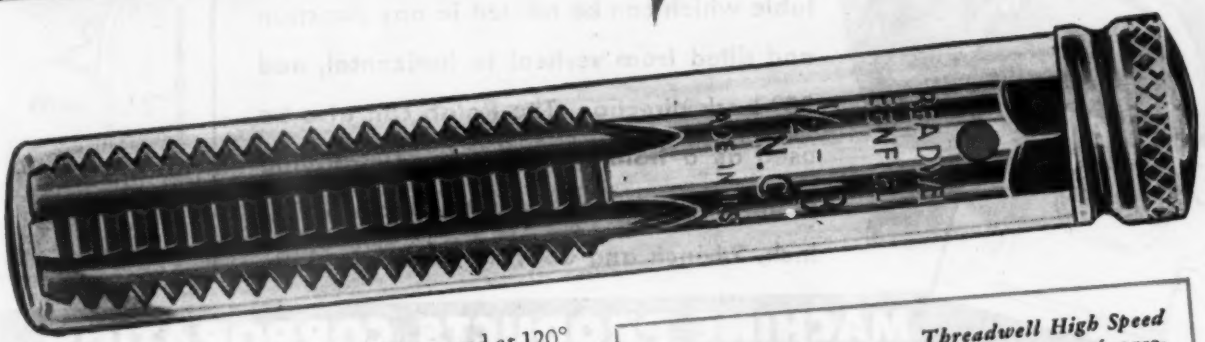
Calol Pinion Grease—5. For open spur gears in severe pressure and temperature conditions. Very heavy and adhesive.

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT

THESE Threadwell TAPS and TOOLS FIT Your NEEDS TO A T

Try Them



Threadwell COLD-TEMPER TAPS, treated at 120° below zero, will quickly demonstrate their ability to turn out more and cleaner threads per tap, whether you're threading steels, cast iron, alloys or plastics.

Every ground thread tap comes in its neat, protective "Tap-Capsule", a transparent plastic tube which with Threadwell's exclusive color "*i-dot-ification*" (*red* dot on the shank for cut thread, *white* dot for commercial ground, *blue* dot for precision ground) makes correct selection sure and rapid. Threadwell Taps are *greaseless rust-proofed*, always clean, dry and shining.

Get in touch with your local Threadwell distributor. He is equipped to give intelligent personal attention to your needs; or write for descriptive folders containing complete information.

Threadwell High Speed Counterbores assure fast production and long life. Designed with two cutting lips with *spiral* flutes for ample clearance and strength, they are easily sharpened, non-chattering. Available with straight or taper shanks for fillister head screws or for spot facing.

Threadwell KeywayCutter Sets give you the fastest, simplest method of cutting keyways to standard width and any desired depth in gears, cutters, couplings, pulley hubs, etc. May be used with any press. (Threadwell offers an ideal Arbor Press for the purpose — light, inexpensive, but sturdy and speedy.)

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THROUGHOUT THE REST OF THE WORLD

Threadwell
SINCE 1902
"TAPS OF DISTINCTION"

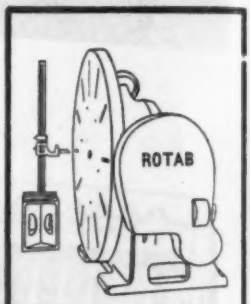
THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21

Announcing the NEW Improved ROTAB

PATENTED

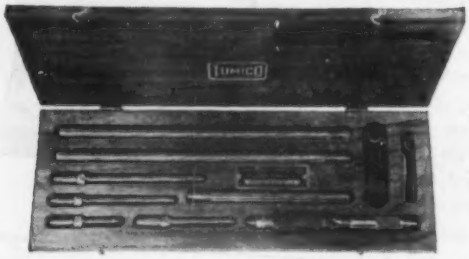
Simplify the checking and measuring of angles on castings or parts with the new improved Rotab. A vernier is conveniently located directly underneath the table for rotary motions, and another opposite the gear control for angular settings. Perfect synchronization between controls and readings is assured. Part is clamped on table which can be rotated in any direction and tilted from vertical to horizontal, and 30° back direction. The Rotab can also be used as a holding fixture for simplifying angle boring or milling. Available in 12-inch, 24-inch and 36-inch sized faceplate.



MACHINE PRODUCTS CORPORATION
6771 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN

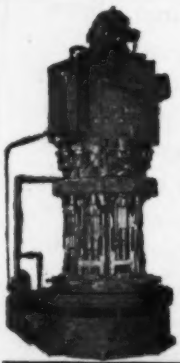
Tubular MICROMETER

FEATHER TOUCH



INSIDE MICROMETER SETS TU-MI-CO TUBULAR Construction—strong, light, easy to assemble and handle. All tips and connecting surfaces are hardened and lapped for long, trouble-free service. Sets complete with mandrels, wrenches, instructions—in strong wood cases.

TUBULAR MICROMETER CO., ST. JAMES, MINN., U. S. A.



Vertical ROTO-MATICS

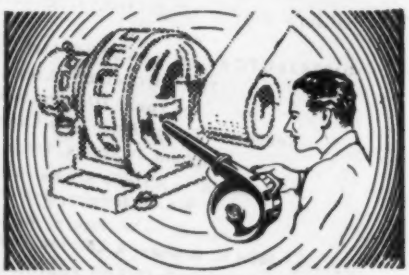
Multiple spindle drill heads and automatic clamping provide added production.

DAVIS and THOMPSON Roto-Matic

Continuous operation is essential for maximum production. VERTICAL ROTO-MATICS are continuous operating, multiple spindle, non-indexing machines that are adaptable to a wide range of machine problems. . . . *Bulletins 110 and 120* may help you solve your problems. Write for them.

Davis and Thompson Co.
Mfrs. of Machine Tools and Micrometers
6411 W. Burnham St. Milwaukee 14, Wisconsin

BLOW OUT DUST DIRT LINT *from* MOTORS *and* MACHINERY *with*



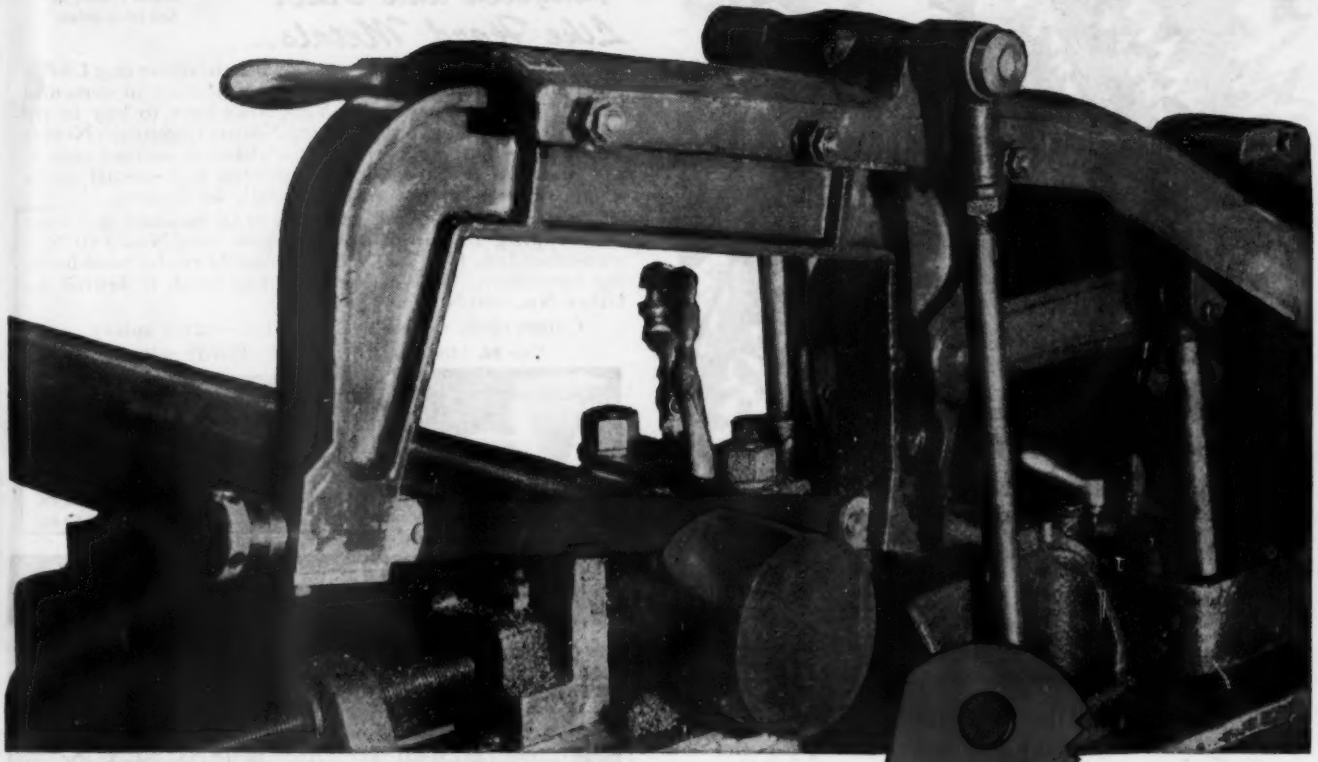
TORNADO PORTABLE ELECTRIC BLOWER

BLOWS clean, dry air at 295 m.p.h. Plugs in at any electric outlet. Costs less than 3c an hour to operate. Easily portable. Weighs only 14 lbs. Cuts power cost. Prolongs equipment life.

FREE TRIAL—write to **BREUER ELECTRIC MFG. CO.**
5084 N. Ravenswood Ave., Chicago 40

Get More Cuts Per Hour and More Hours Per Machine with

SIMONDS "Red End" HACKSAW BLADES



THESE rugged "Red End" Blades for power-machine use are made to take the toughest service, *and to keep on taking it.* Smoother, straighter cutting . . . higher production . . . longer blade life . . . all these *extras* are now possible through Simonds 100% quality-control, and through Simonds new scientific method of tensioning power hacksaw blades to each particular job on which they are used. "Red End" Blades are made from Simonds own special electric steel, either standard, molybdenum, or high-speed. Order from your dealer *now.*

SEE SIMONDS NEW SOUND FILM, 16 mm in full color, showing how to choose the right "Red End" Blade for each job, and how to get the most out of it *on the job.* Have your dealer arrange to show it to *your* operators, in your own shop, without cost or obligation.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington.

PRODUCTION TOOLS FOR CUTTING METAL, WOOD, PAPER, PLASTICS

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASSACHUSETTS

CUT THE WAR SHORT . . . BUY WAR BONDS . . . AND THEN BUY MORE WAR BONDS

WHEN you think "postwar" you inevitably think of *higher production at lower cost.*

Good cutting fluids, properly applied, are always an important factor in achieving the greatest efficiency in metal working. When you can reduce machine down-time, improve work finish and save tools, your competitive odds are better.

D. A. Stuart Oil Company have been making and applying cutting fluids since 1865—gathering experience that is long, broad and successful—experience that you may use to advantage. Invite a Stuart Oil Engineer into your plant and through him the Stuart Organization will work with you in setting up cutting fluid standards for the top metal-working efficiency you will need for the times to come. No obligation, of course.

The 60-page Stuart booklet, "Cutting Fluids for Better Machining", contains interesting facts about cutting fluids and their application. *Write D. A. Stuart Oil Company, Limited, 2733 So. Troy Street, Chicago 23, Illinois.*

D. A. Stuart Oil CO.
LIMITED
ESTABLISHED 1865
Stocks in Principal Metal Working Centers

Try it FREE!
U. S. P. Co. NORBIDE COMPOUND

When ordering sample — SPECIFY GRIT SIZE. See table below.

For Lapping Cemented Carbides, Tungsten and Other Like Hard Metals...

Now you can prove to your own satisfaction that USPCo Norbide Compound will speed the efficiency of cemented carbide lapping operations. You don't have to buy to try! Norbide Compound is made using Norton Company's Norton Boron Carbide shown below. This abrasive, second only to the diamond in hardness, is suspended in a special grease composition paste base made especially for lapping.

Norbide Compounds are made in all standard grit sizes. For ripping or roughing dies, grit size No. 240-N is recommended. No. 320-N or No. 400-N are for semi-finishing operations. Where extremely fine finish is desired use either No. 600-N or No. 800-N.

Comes ready mixed—ready to use—saves money!

One oz. sample jar sent FREE. Specify grit size.

NORBIDE COMPOUND PRICES

Size Jar	Grit Size	Price
1 oz.	All grades	$2.00 ea.
8 oz.	240-N and Coarser	4.00 ea.
8 oz.	320-N	4.50 ea.
8 oz.	500-N and 600-N	6.00 ea.
8 oz.	800-N	8.50 ea.

(Prices: F. O. B. Pittsburgh, Pa.)

UNITED STATES PRODUCTS CO.
518 MELWOOD ST PITTSBURGH, PENNA.

LUERS
Patented Cutting Off Tool Holder
Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

Manufactured By
J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.
Produced under License Issued by John Milton Luers Patents, Inc.

HOLMAN
BETTER, FASTER HOLE FINISHING

HELICAL TAPER PIN REAMERS

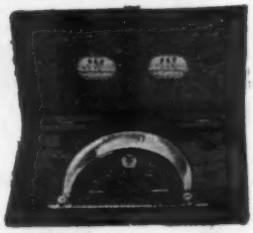
Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
MANCHESTER, CONN.

D&T MICROMETERS AND SNAP GAGES

Tubular welded frames with forged ends insure a maximum of accuracy with a minimum of weight.

There are a variety of types available with either micrometer heads or dial indicators to cover a range of capacities from 0 to 168 in. . . *Write for Bulletin 200* or outline your gaging problems.



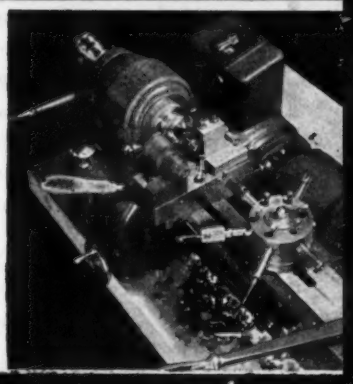
• D & T Bow Micrometer 0 to 6 in. capacity

Davis and Thompson Co.
Mfrs. of Machine Tools and Micrometers
6411 W. Burnham St. Milwaukee 14, Wisconsin

Integral Drive

PRECISION BENCH LATHE

A new stream-liner incorporating all the old Stark accuracy and stamina



THE first tool of its class with built-in Motor and speed changing mechanism (patented). Marvelously compact; nothing under the bench; no special bench or cabinet needed; even bolting down unnecessary:

Simply moving control lever to right engages the clutch, vertical position releases; moving to the left instantly brakes the moving spindle.

Standard (tool room) Model has time-tried double taper spindle bearings 156 to 2200 r.p.m.—the best for sustained accuracy.

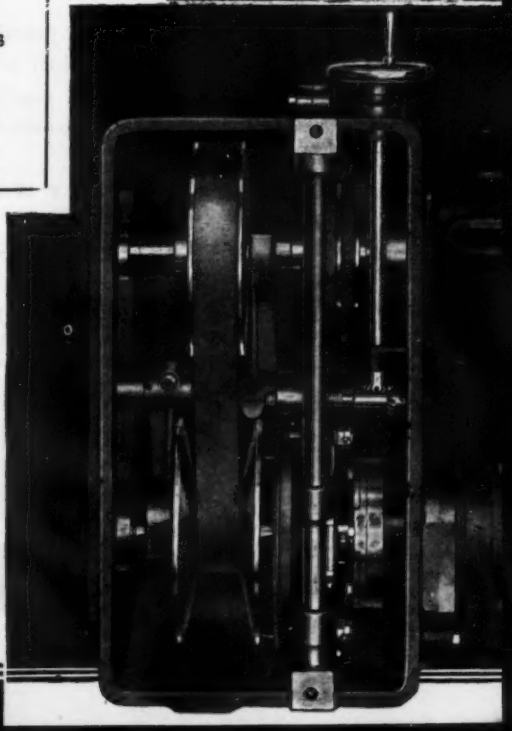
High speed (manufacturing) Model fitted with best precision pre-loaded anti-friction bearings, 360 to 3500 r.p.m.

Open Cone Lathes
in ¼", ½", ¾" & 1" sizes

Stark Motor Drive Unit
Smooth and Reliable

Precision Bench Millers
with best Indexing

Precision Attachments
Collets & Fine Tools



Both have 40 inch bed, 9 inch swing, 20 inches between centers; either ¾ or 1 inch collet capacity. Take regular STARK Attachments collets and chucks. This Stark (patented) built-in drive, integral with the Lathe itself, employs a ½ h.p. geared ball-bearing motor drive through a disc clutch, and through V belts to the headstock, giving any split speed at the turn of the small hand wheel in front of operator.

Write for full information

STARK TOOL COMPANY

WALTHAM, MASS., U. S. A.

ESTABLISHED 1862

ORIGINATORS OF THE AMERICAN BENCH LATHE

Give Solder STAYING Power

Photo Courtesy of Stanley Tools

USE KESTER FLUXES for Permanence!

Don't risk service difficulties, mechanical failures, with solder flux that won't hold tight! Chemically correct flux—and different fluxes for different types of operations—are imperative for permanent soldering. That's why Kester fluxes are scientifically compounded to form tight, clean solder-bonds resistant to shock, vibration, bending, contraction and expansion. They insure the lasting quality of your product!

For over 45 years Kester Fluxes have been tried, tested and proved dependable. There is a wide range of Kester flux formulas to fit every possible solder operation.

Consult Kester engineers for practical, experienced help in solving any solder problem you may have. They'll gladly suggest the right flux to protect your product—and at no obligation.

☆ BUY WAR BONDS ☆

KESTER SOLDER COMPANY
4223 Wrightwood Ave., Chicago 39, Illinois
Eastern Plant: Newark, N. J.
Canadian Plant: Brantford, Ont.

KESTER
Solder Fluxes
STANDARD FOR INDUSTRY

Almond Drill Chuck

The Pioneer

Almond Three-Jaw Drill Chucks were Pioneers in their field—the first to be placed on the market. They have formed a necessary part in the logical procedure of machine developments over the past seventy and more years.

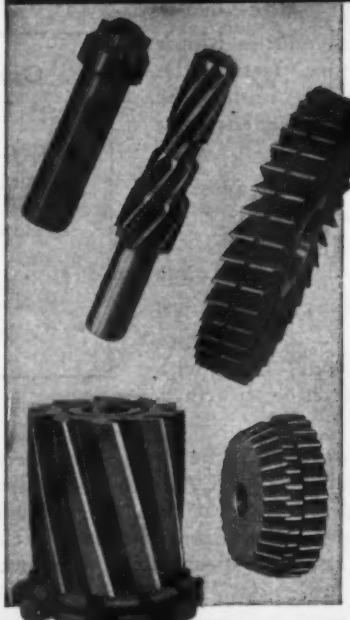
Almond Drill Chucks are made in types and sizes to fit all machine tools and portable drills.

Write for complete details

T. R. ALMOND MFG. CO.
ASHBURNHAM, MASS., U. S. A.

The Original Manufacturers of Drill Chucks

PRECISION TOOLING



To Beat the Japs or Solve Your Postwar Problems

The Pacific war is still making heavy demands upon all of us.

But you, undoubtedly, are looking forward to resuming the production of civilian goods.

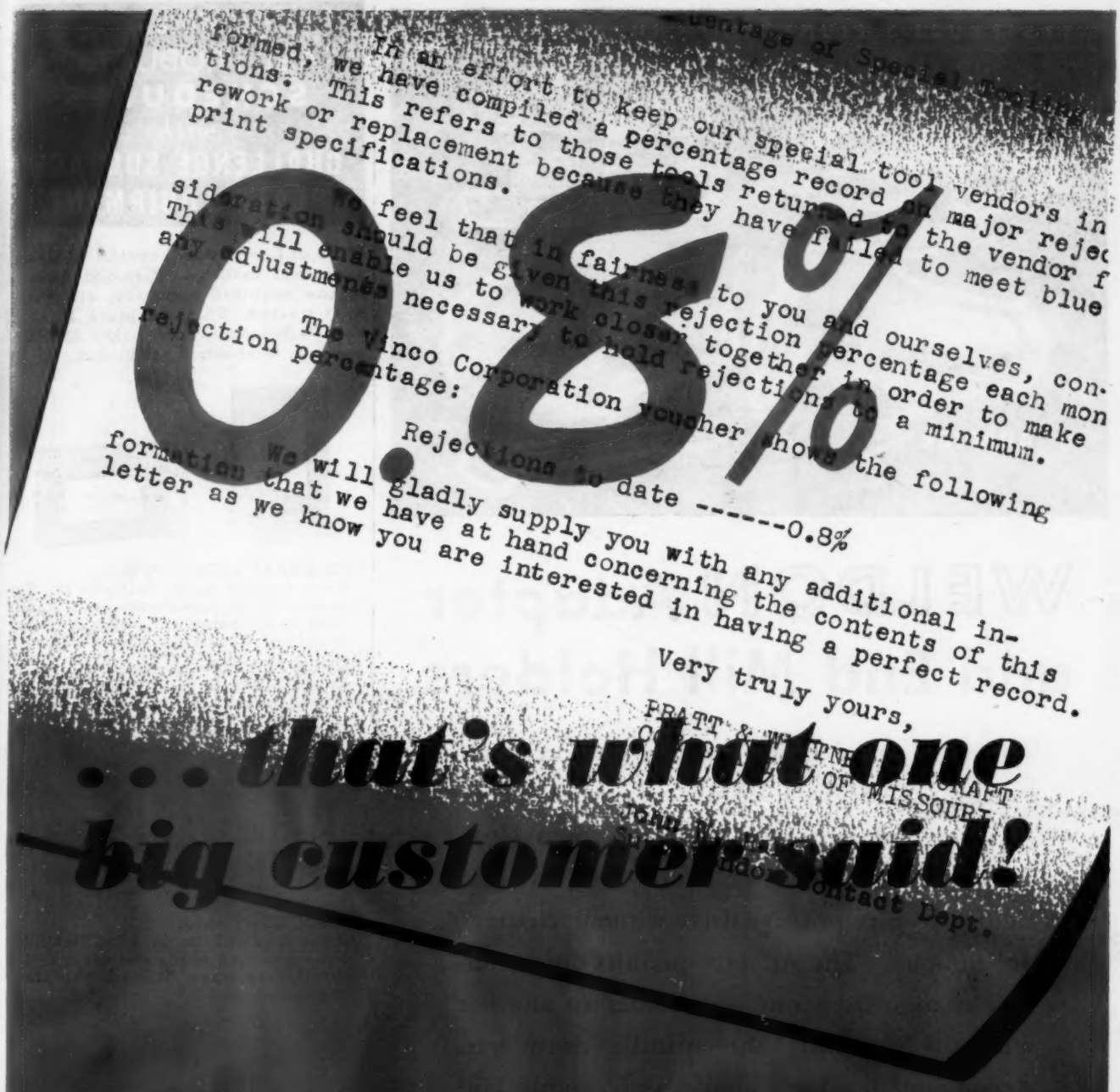
And we are ready to bring our war-won experience to your postwar tooling problems.

Send your inquiries to our engineering Dept. for prompt estimates.

AMERICAN CUTTER
AND ENGINEERING CORPORATION
31741 MOUND ROAD WARREN, MICH

BUY MORE WAR BONDS—HELP CUT DOWN THE JAPS

A.C.E. SPECIAL CUTTING TOOLS
HI-SPEED OR CARBIDE-TIPPED



Percentage of Special Tooling

In an effort to keep our special tool vendors in formed, we have compiled a percentage record on major rejec tions. This refers to those tools returned to the vendor f rework or replacement because they have failed to meet blue print specifications.

We feel that in fairness to you and ourselves, con sideration should be given this rejection percentage each mon This will enable us to work closer together in order to make any adjustments necessary to hold rejections to a minimum.

The Vinco Corporation voucher shows the following rejection percentage:

Rejections to date ------0.8%

We will gladly supply you with any additional in formation that we have at hand concerning the contents of this letter as we know you are interested in having a perfect record.

Very truly yours,

PRATT & WHITNEY AIRCRAFT
CORPORATION OF MISSOURI
John [illegible]
Supervisor, Vendor Contact Dept.

Many other customers have complimented us on our craftsmanship but this simple, unadorned statistical fact that we are 99.2% right is not only pleasant to our ears but is also added assurance that Vinco will never lower the high standard of workmanship that personifies Vinco Products and Services.

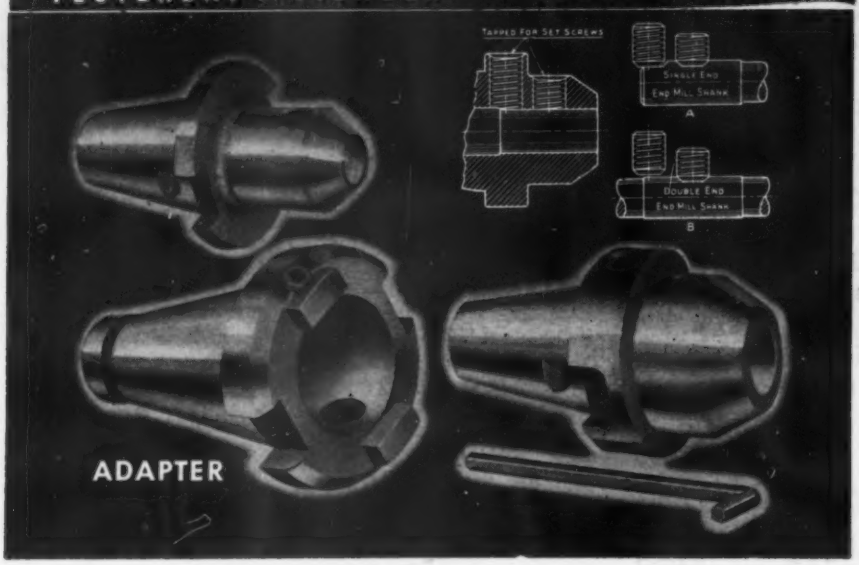
MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8851 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development.

YESTERDAY'S PIONEER · · · TODAY'S LEADER



WELDON Adapter and End Mill Holders

To speed production and insure precision cutting, WELDON originated the type of Adapter and End Mill Holders shown here. The Holders grip the end mill with absolute rigidity to give positive drive without "chatter" or "run-out". The Adapter permits quick and easy change from one size holder to another without loosening the spindle draw bar. Accommodates both single and double end mills in shank diameters of seven sizes. These are stock items designed and built to the WELDON quality standard.

Insist on WELDON TOOLS FOR WELL DONE JOBS.

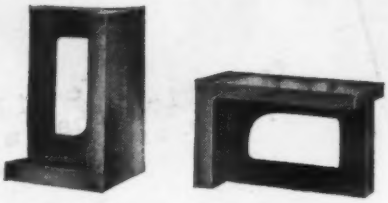
Write for Catalog 8-B

THE WELDON TOOL CO. Cleveland 4, Ohio

3000 WOODHILL ROAD

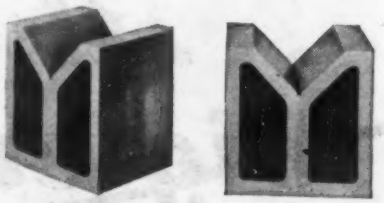
Maintain
FAST PRODUCTION SCHEDULES *with*
CHALLENGE SURFACE PLATE EQUIPMENT

Made of fine-grained, special analysis, semi-steel castings. Precision ground to the required accuracy, specially heat-treated. This complete line of shop-tested equipment makes for fast, accurate, trouble-free production.

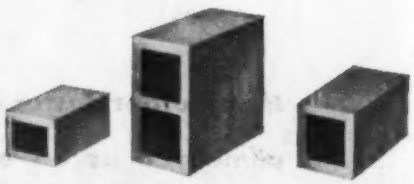


UNIVERSAL IRONS—4 sizes.
From 4x5x3¾ in. to 8x10x5½ in. For providing square reference lines. Handhole in stiffening rib makes for easy handling. Companion pieces—

ANGLE PLATES—22 sizes.
From 3½x4x4 in. to 24x24x24 in. For clamping and holding work.



V-BLOCKS—7 sizes.
From 2x2½x5 in. to 12x12x12 in. For supporting shafts and other cylindrical work when drilling, checking, inspecting, etc.



BOX PARALLELS—18 sizes.
From 1½x2x4 in. to 12x12x24 in. For setting and leveling to parallel and exact height for checking and inspection. Also available—

SOLID PARALLELS—18 sizes.
From ¼x⅝x6 in. to 1¼x2x12 in.

LATEST CATALOG

Illustrates and describes complete line of Challenge precision equipment. Send for it today—now!

THE CHALLENGE MACHINERY CO.
1917 50th ANNIVERSARY 1943
GRAND HAVEN, MICH., U. S. A.

WHEN AIR POWERS THE HAMMER

Each blow is uniform throughout the day and production is increased when air hammers do the work. These tools are popular with workers because they are light in weight and easy to hold. This means that fatigue is kept at a minimum and the operator can produce more work with less effort.

Years of continual research and improvement have enabled us to produce many types and sizes of hand-held air tools. In addition to air hammers for chipping, scaling, riveting, digging, tamping, etc., we have a complete line of air drills, reamers, wrenches, grinders, etc. They are all favorites. When you buy an I-R air tool you get one that is powerful, durable, safe, and easy to hold.

Consult our nearest office for recommendations on the proper tool for the job.

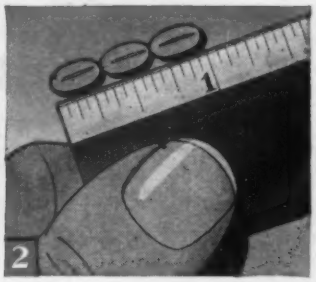
Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES • CONDENSERS • CENTRIFUGAL PUMPS

What's a cubit? Ask any old Egyptian!

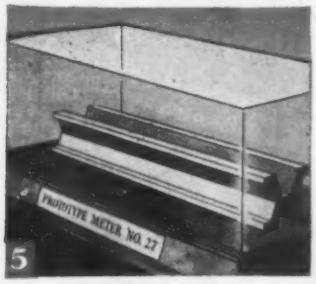
Egyptians measured by *cubit*—length of a human forearm.



In 1324, England figured three barley corns made a fair *inch.*

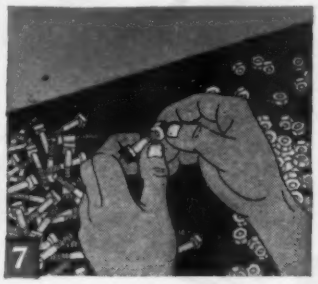
In 1500, the left feet of any 16 Englishmen totaled a *rod.*

From King's nose to fingertips was a *yard* in medieval France.

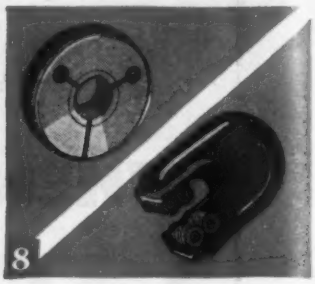


In 1875, the *meter* was adopted to aid standardized production.

Next came *master gages* for closer dimensional control.



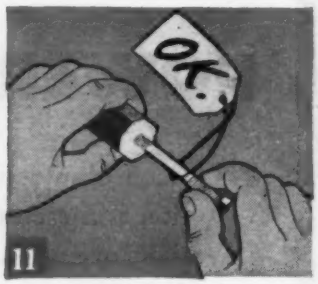
By 1930, *gage* accuracy made parts fully interchangeable.



Ring type gages are accurate; Roll Snap Gages speedier.

Woodworth's LIMITROL Gage combines best features of both.

Inexperienced inspectors use it with speed and accuracy.



If a part passes the LIMITROL, it will assemble.

Industry lauds LIMITROL'S accuracy and high capacity.

What Woodworth Accuracy Means to Production

WOODWORTH, to industry, is another name for *precision*—precision gages, precision tools, precision machined parts.

There is a reason for this.

Every Woodworth product must conform to the basic policy of this company . . . *to make only products which will benefit industry through increased production and reduced costs.*

This means that the great demand for Woodworth Tools and Gages will be continuing, especially in view of the coming battle for postwar markets.

And it means that Woodworth engineers have been charged with the responsibility of searching constantly for new ways to speed up and lower the cost of production, in connection with Woodworth products of the future.

The constant growth and expansion of the N. A. Woodworth Company is due to strict adherence to these objectives.

ACCURACY YOU W CAN TRUST

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD, DETROIT 20, MICHIGAN

PRECISION GAGES

PRECISION MACHINED PARTS

PRECISION TOOLS

BUY WAR BONDS

DO YOU WASTE DOLLARS and MACHINE HOURS doing unnecessary grinding?

Are you one who still buys cut-off tools in more or less blank form and then, before you can use them, must spend valuable time grinding clearances to meet your requirements?

If you are, you can stop this waste of dollars and machining-hours right now! Start using the Empire Tool Company's Luers Patented Cutting-Off Blades that come to you with ALL the clearances provided—ready for use when you receive them.

These blades are used in holders designed specially for any standard hand or automatic screw machines—can be locked and released instantly without disturbing set-up.

Our engineers (located in principal cities) will gladly call at your request to assist you in simplifying your cutting-off operations.

Empire Tool Company manufactures Luers Patented Cutting-off Blades and Holders under license issued by John Milton Luers Patents, Inc.

SEND FOR COMPLETE CATALOG

TRY EMPIRE PRODUCTS *for 30 days*

If you're not thoroughly satisfied, return them for full credit.

EMPIRE TOOL COMPANY

8774 GRINNELL AVENUE

DETROIT 13, MICHIGAN

We are also manufacturers of Empire Floating Tool Holders, Distributors of Fastcut Centerdrills and Keyseat Cutters and Rigid Live Centers

VITRIFIED

Keep production on its toes by standardizing on . . . VITRIFIED GRINDING WHEELS

The Vitrified complete line includes also Silicate, Shellac and Resinoid bonded wheels for conditions requiring high finish, elasticity and heat resistance.

Grinding equipment—for tools or for production requirements—can be brought to higher degrees of precision and speed by standardization of Grinding Wheels.

These objectives can easily be realized through the use of Vitrified Wheels for every grinding operation, because Vitrified offers a complete line of sizes, shapes and types, processed especially for the work to be handled.

. . . Cast Iron, Bronze, etc., can be ground at low cost and efficiency on Vitrified Carborite Wheels. . . . For accurate, fast grinding of steel on a production basis, Vitrified Borite Grinding Wheels increase output and reduce costs.

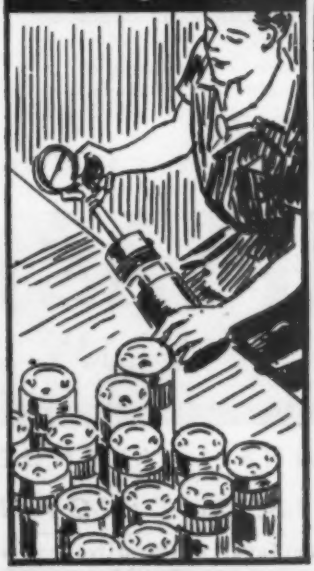
. . . Also, make Silicate, Shellac and Resinoid Bonded Wheels.

Ask a Vitrified representative to show you how economically you can modernize your grinding operations by standardizing on Vitrified Wheels.

Vitrified Wheels

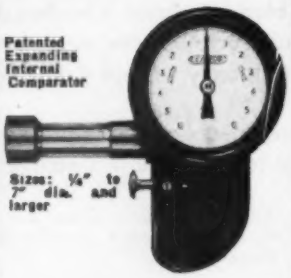
VITRIFIED WHEEL CO.
WESTFIELD CONN.

Automatic features assure high precision internal gaging



Assured accuracy in gaging precision bores to fractions of .0001"

COMTORPLUG



The shock-absorbing Comtorplug's unique features of self centering and alignment assure positive accuracy in the hands of ordinary machine operators and bench inspectors, and supplies the "laboratory accuracy" demanded by highly skilled final checkers. Fixed reading shows true size 2-point contact reveals out-of-round, front or back taper, barrel shape, etc. Now readily available in wide range of diameters and in reaches.

Request Bulletin 31

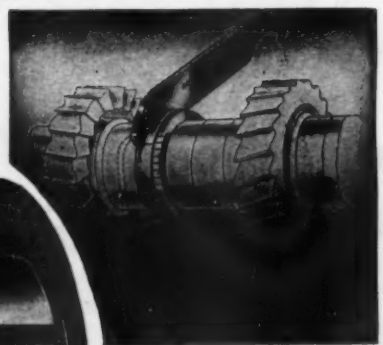
THE COMTOR CO.
68 Rumford Avenue
WALTHAM MASS.

SAVE TIME ON YOUR GANG MILLING SET-UPS

You are assured FAST—ACCURATE spacing on all side milling cutters and gang milling set-ups with

DAYTON ROGERS ADJUSTABLE SPACING COLLARS

Just loosen cutter arbor nut and make plus or minus adjustment with handy wrench as shown.



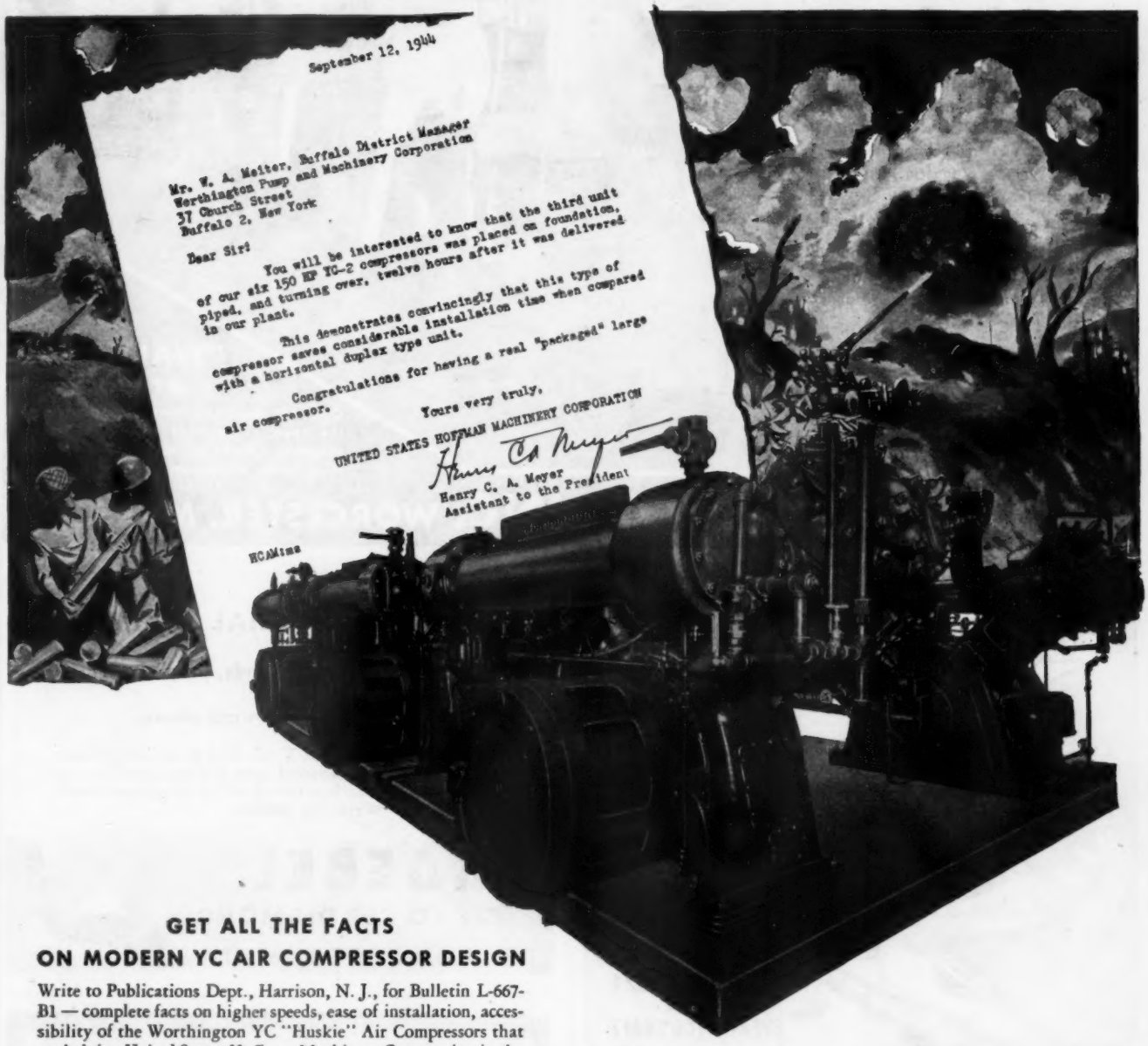
"DAYTON ROGERS" ADJUSTABLE SPACING COLLARS are graduated in thousandths, with plus or minus markings as illustrated. A .0005 adjustment can easily be made by visual calibration. These collars are made in 12 standard sizes from ⅞" to 2".

Write for illustrated bulletin 2120-1

DAYTON ROGERS MFG. CO.
2826 12th Ave. S. Minneapolis, Minn.

RUSH MORE SHELLS!

Worthington "Huskies" Quickly, Easily Installed by United States Hoffman Machinery Corporation


September 12, 1944
Mr. W. A. Meiter, Buffalo District Manager
Worthington Pump and Machinery Corporation
37 Church Street
Buffalo 2, New York
Dear Sir:
You will be interested to know that the third unit of our six 150 HP YC-2 compressors was placed on foundation, piped, and turning over, twelve hours after it was delivered in our plant.
This demonstrates convincingly that this type of compressor saves considerable installation time when compared with a horizontal duplex type unit.
Congratulations for having a real "packaged" large air compressor.
Yours very truly,
UNITED STATES HOFFMAN MACHINERY CORPORATION
Henry C. A. Meyer
Assistant to the President
HCAMims

GET ALL THE FACTS ON MODERN YC AIR COMPRESSOR DESIGN

Write to Publications Dept., Harrison, N. J., for Bulletin L-667-B1 — complete facts on higher speeds, ease of installation, accessibility of the Worthington YC "Huskie" Air Compressors that are helping United States Hoffman Machinery Corporation in the manufacture of shells. Adaptable . . . direct-connected, or easily arranged for belt drive on practically any type of rotative power. Another reason why *there's more worth in Worthington.*

Worthington Pump and Machinery Corporation, Buffalo Compressor Division, Buffalo, N. Y.

8C4-18

WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

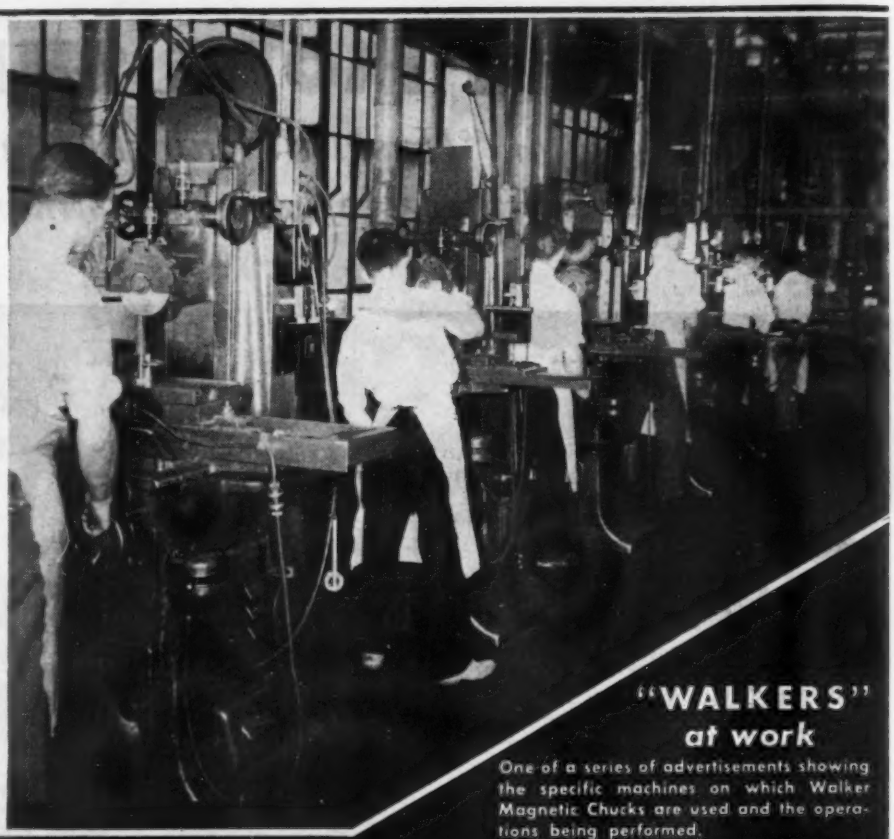
Y-types | Vertical | Horizontal | Portable | Radial | Gas-Engine Compressors

When jobs call for PRECISION . . . *the choice is* "WALKER"

Walker Magnetic Chucks on Abrasive Grinders—as shown here—provide a combination which assures high precision work. This application suggests many others where "Walkers" can be used to advantage. We therefore suggest that you get in touch with the builders of your grinders and other machine tools and let us cooperate with you and them in helping select the proper Walker Magnetic Chucks for your specific requirements.

Walker Electro-Magnetic Chucks are now available in All-Purpose Longitudinal & Bar Pole Types and in Plain & Swivel Types Permanent Magnetic Types.

Ask for further details on the new developments in Walker line and for assistance in meeting your chucking problems.



"WALKERS" *at work*

One of a series of advertisements showing the specific machines on which Walker Magnetic Chucks are used and the operations being performed.

O. S. WALKER CO., INC. WORCESTER, MASS.

The Greatest Improvement in Flexible Shaft Construction Since the Use of Wirewound Cores

In flexible shafts the wire core wears out first. Exclusive with WYCO Flexible Shafts is this Patented Non-Metallic Innerliner that makes the core last far longer; run more smoothly; transmit more power.

The WYCO Innerliner does . . . Protect piano wire core from frictional contact—Prevent excessive wear—Prevent crystallization of core (prolonging life)—Insure cool and truer running shafts, free from vibration. Standard Equipment with every WYCO Flexible Shaft Machine.

There is a WYCO Flexible Shaft Machine for Every Service Requirement.

Send for the WYCO Catalog

WYZENBEEK & STAFF, INC.

830 W. Hubbard Street Chicago 22, Ill.

WYCO FLEXIBLE SHAFT EQUIPMENT and PROFIT PRODUCING TOOLS

Regarding **INDUSTRIAL DIAMONDS—**

first, **use GOOD diamonds, properly set.**

follow **with proper use—not abuse.**

KOEBEL Diamond Tools and Koebel literature on diamond care are designed to provide maximum value from your tools. Write for details.

Whoever thinks of hardness testing equipment thinks of the

"ROCKWELL" HARDNESS TESTER

Now and always made only by

WILSON

MECHANICAL INSTRUMENT CO. INC.
357 Concord Ave., New York 54

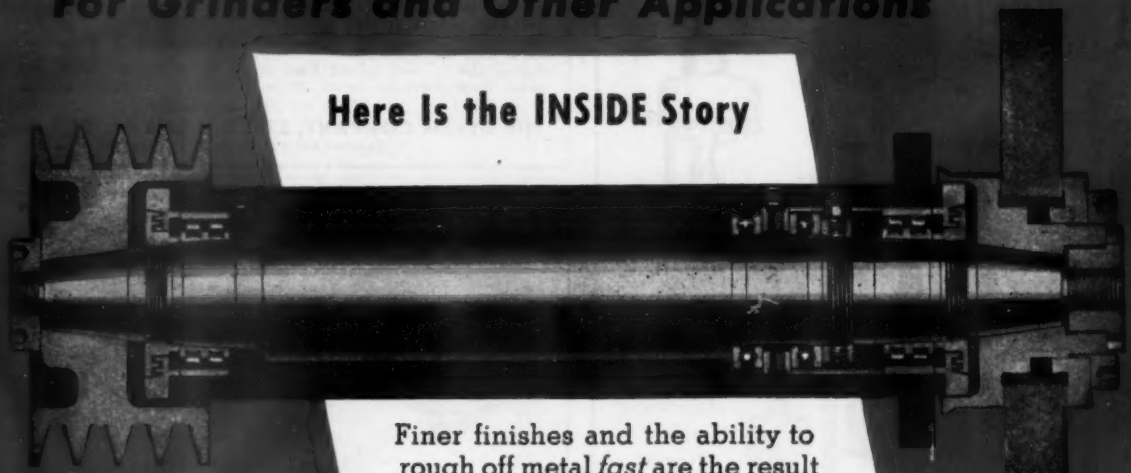
An Associate Company of American Chain & Cable

POPE PRECISION SPINDLES

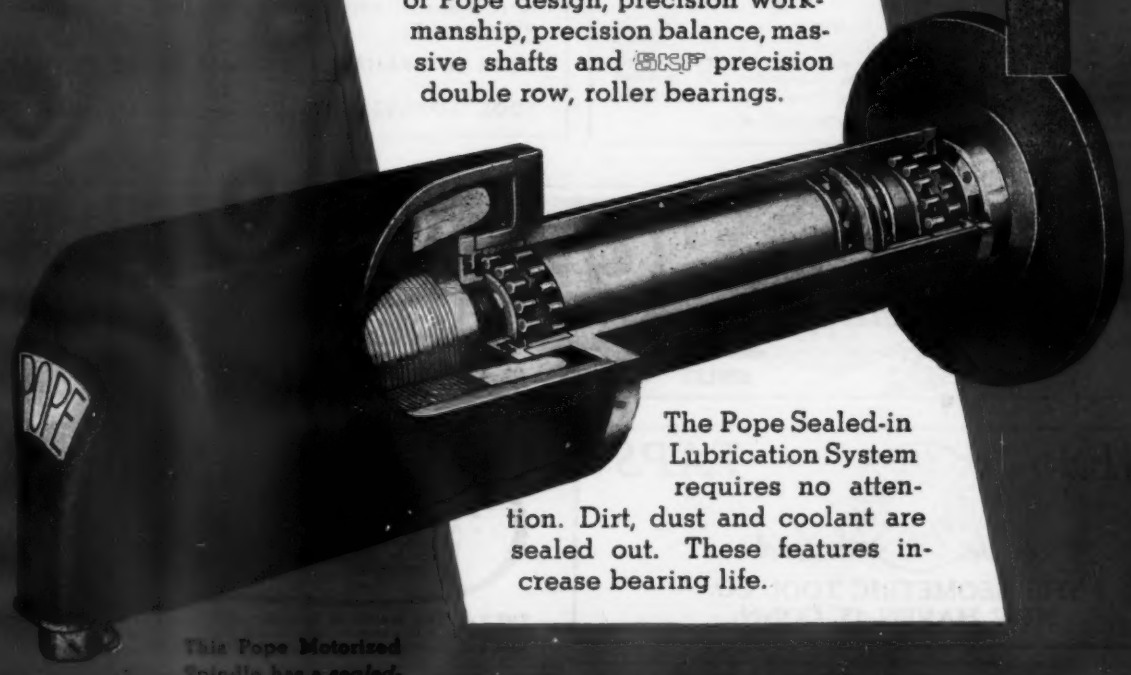
with *Sealed-In* Lubrication

For Grinders and Other Applications

Here Is the INSIDE Story



Finer finishes and the ability to rough off metal *fast* are the result of Pope design, precision workmanship, precision balance, massive shafts and SKF precision double row, roller bearings.



The Pope Sealed-in Lubrication System requires no attention. Dirt, dust and coolant are sealed out. These features increase bearing life.

This Pope Motorized Spindle has a *sealed-in* motor as well as sealed-in lubrication.

Send us a sketch or brief description, with dimensions, of the spindle you want. We will send you an outline drawing with a quotation.

No. 25

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

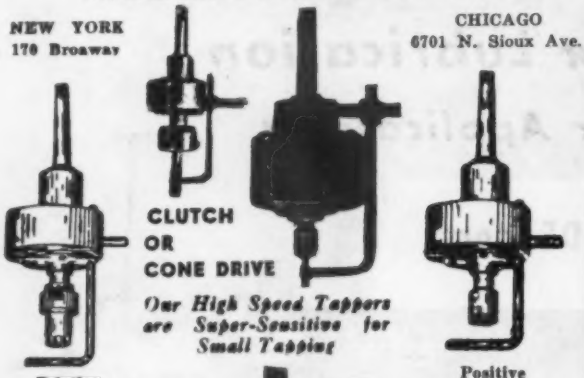
ERRINGTON MECHANICAL LABORATORY

TAPPING CHUCKS

STAPLETON, STATEN ISLAND 4, N. Y.

NEW YORK
170 Broadway

CHICAGO
6701 N. Sioux Ave.



CLUTCH
OR
CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Friction
No. O O C. S.

Positive
No. O O H. S.

Style B Positive Stop Holds Work Down

Style C Graduated Adjustable Safety Friction

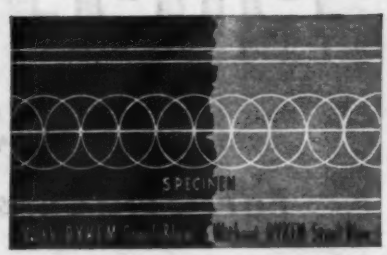
DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder. If required. Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2301 B N 11th St., St. Louis, Mo.
In Canada: 444 Pacific Ave., Toronto, Ont.

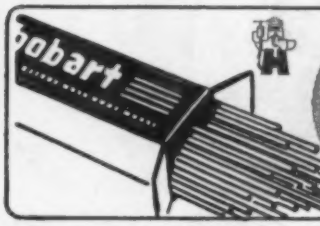
"BURROFF"

PAT. NO. 2351578

For fast clean removal of burrs and chamfering holes (inside & outside) of multi-walled parts—where regular solid countersinks will not reach.

CONTACT:
JOHN H. GRAHAM & CO.—105 DUANE ST., N. Y. C.

MADE BY
TOOL IMPROVEMENTS CO. — SEAFORD, NEW YORK



Use the IMPROVED HOBART ARC WELDING ELECTRODE
Write for Particulars

HOBART "Simplified" arc welders

"One of the World's Largest Builders of Arc Welders"

HOBART BROTHERS CO., Box A.M. 9-13 TROY, OHIO

DIES TAPS

GEO MET RIC

Right in the Lead

THE GEOMETRIC TOOL CO.
NEW HAVEN 15, CONN.

Famous for

- ACCURACY OF THREADS
- LOW CHASER COST
- ALL AROUND DEPENDABILITY

Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

See our Advt. on page 238 Jan. 18, '45, American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
Los Angeles: A. C. Behringer, 524 N. San Pedro St., San Francisco: Guy Reynolds, 464 Vernon St., Oakland, Canada: F. Barber Machinery Co., Toronto, Canada.

POWER HACK SAW ★

LOW PRICED
SELF-CONTAINED
PORTABLE
STURDY
READY TO WORK
ECONOMICAL

Angle Cutting Vise

EXPORT DEPT.
1111 SO. FERRY BLD'G.
NEW YORK 4, N.Y.

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MILLER-KNUTH MFG. CO. OMAHA, NEB.

RANDALL and STICKNEY
Dial Gauges and Indicators

Model C

are accurate, reliable and built to stand the gaff of hard usage.

This Model C Dial Indicator has a 2½ in. diameter dial, with 50 or 100 divisions. Can be furnished in graduations of .001-in., .0005 in. or .01 mm. Has a ½-in range, movable dial easily set at zero.

The cases on all R. & S. Gauges are made from sturdy castings. The case and plate are two separate units, so that repairs can be made easily.

There is a R. & S. Gauge for practically every purpose. Write for circulars describing our complete line.

RANDALL & STICKNEY
Waltham 54, Mass., U. S. A.
Makers of Dial Gauges Since 1885

BEFORE YOUR PRODUCT SPROUTS WINGS

CHECK WITH VARD

GAGE ENGINEERING SERVICE

The time to fore-see trouble is at the blueprint stage. Of all production problems, one of the toughest to solve is balanced delivery of uniform, accurate machined parts. Gage Engineering can help you.

VARD Gage Engineering is a plan to insure Quality Control and coordination in machine manufacture or assembly. Here's how it works. Send us a set of blueprints; a pilot model of your product, or both. Our experienced Gage Engineers and production men will make a careful examination of your requirements. We will then submit our quotation covering the Gage Engineering service. Upon your acceptance of our quotation we will prepare a complete report of gaging techniques, fixtures and necessary gages—their types, sizes and tolerances. We will also furnish a firm bid covering the recommended gages and inspection equipment.

The cost of Gage Engineering per unit in production is minute, the results are gratifying.

GET QUALITY CONTROL

VARD'S program of Gage Engineering must always be subordinate to our gage making business. For the reason that good Gage Engineers are few and far between, we cannot expect to make this service available to all, but on the basis of first come—first served. We will endeavor to handle your inquiries with dispatch.

VARD INC.
PASADENA 8, CALIF.

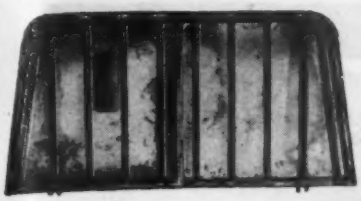
ARMY E NAVY

This sort of Goods* can be fabricated cheaply... and FAST

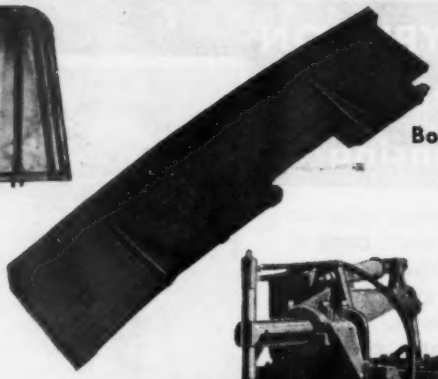
*and thousands of other items too varied to describe

*Federal also makes all other types of resistance welders.

THE Federal MACHINE AND WELDER CO.



Cabinets and Doors



Body Panels

on these types® of

Federal

RESISTANCE WELDERS

Let us tell you How

MEMBER RESISTANCE WELDER MANUFACTURERS ASSOCIATION · RWMA

230 DANA ST.
WARREN, OHIO

VERSATILE MODERN PRODUCTION TOOLS

READY-TO-NAIL MOULDINGS

Decorative or utility type metal mouldings with steel brads permanently attached, ready for continuous nailing, are made on a high production basis with the aid of automatic resistance welding employing a press type welder developed by The Federal Machine and Welder Company. The moulding is automatically indexed for proper spacing and the brads automatically cut and fed from wire reels. They go on in a hurry, and they never come off. The process is adaptable to many sizes of moulding and brads or nails.

"SELF-FASTENED" FABRICATIONS

Heavy duty metal tool and tackle boxes are made in the modern manner without the aid of any fasteners other than weld nuggets of the fabricated metal. One manufacturer has devised a lid-locking box in which not only is the box itself completely resistance welded, but hinges, handles and even the removable tray are made without fastenings. Using Federal spot welders with variable electrodes, this method can be made highly flexible . . . profitable on small runs of a variety of sizes and styles of containers. Such welders, operated according to instructions, make fabrications that are well nigh indestructible . . . neat and modern in appearance.

USEFUL SPOT WELDER BOOK

Detailed descriptions of a complete line of rocker-arm type spot welders made by The Federal Machine and Welder Company, plus some interesting discussion of the type of work to which they are best suited, are included in a new book offered by this company. Designated as "Bulletin No. 4510", it contains helpful information on air-operated, motor-operated and foot-operated spot welders.

The new book gives a clear idea of what a rocker-arm spot welder is and what it can do. It combines data formerly available in a group of separate folders, and is designed to simplify the problem of selecting the type of spot welding equipment best suited to particular production set-ups. Free copies may be had on request.

Positive action of BARRETT TYPHOON CENTRIFUGAL WASHERS provides for quick, thorough parts cleansing

In these efficient centrifugal machines the washing solution enters the top of the whirling load under valve control. The operating principle—being that of a typhoon—gives the washing solution a spraying, swirling, and surging action which thoroughly permeates the contents. During this action, centrifugal force creates hydrostatic pressure within the basket. That proportion of the deluge going to the bottom is forced up the side and out carrying off the contaminated fluid.

A thorough, quick cleaning is definitely assured by flowing sequence. Two or more liquids may follow, making it possible to wash, rinse or provide any further treatment as required.

Several Barrett installations involve the use of four machines operated by one man who loads and unloads in three minute cycles. Washing time is only one minute. Another type of set-up provides for recovering oil, washing, drying, and coating with rust-proofing material.

As in all Barrett Centrifugal machines, provision is made for convenience and safety of operation.

Send at once for details of Barrett Typhoon Washer

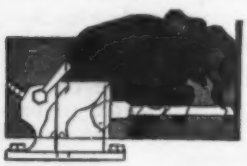
Barrett Centrifugal Washer — made in capacities from 13 to 38 cu. ft. per hour. Each size, depending on condition, will perform at the rate of 20 duty cycles per hour.

THE LEON J. BARRETT COMPANY, 1800 Grafton Road, **WORCESTER, MASS.**

Designers and Builders of Centrifugal Machinery

MEAD *Presents the* AIR PRESS

These new Mead Air Presses deliver 400 and 1200 lbs. pressure respectively on 100 PSI. Handle many staking, crimping, assembly, and similar operations. Clearances 4" and 7½" respectively. With foot control these presses will speed up countless bench jobs, save muscular effort. Write for new Air Power Catalog — just off the press.



MEAD SPECIALTIES COMPANY

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Dept. MA-85 • CHICAGO 41, ILL.

ABRASIVE

ACCURACY BOOSTS PRODUCTION

No. IG	INTERNAL GRINDER	**No. 34**	VERTICAL SPINDLE SURFACE GRINDER
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Look for Our Full Page Advertisements

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SAFETY Wedge Grip LETTERS and FIGURES

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- Deeper impression with less exertion
- Will not spall, will not mushroom
- 25% to 50% more service
- Any size character from 1/16" to 1"

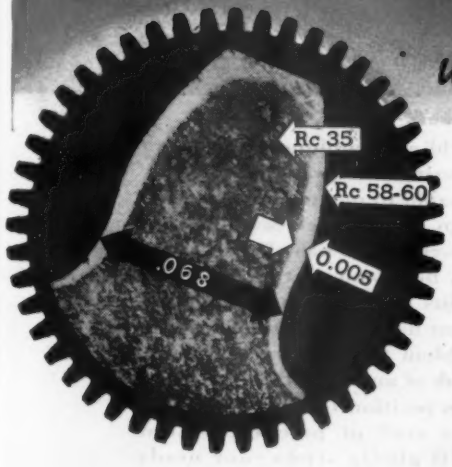
HELP PREVENT AN ACCIDENT TODAY!

M.E. CUNNINGHAM CO.
SAFETY STEEL STAMPS
95 E. Carson St., Pittsburgh 19, Pa.

They're All Talking About It!

A New Thin Case Contour Hardening Job . . .

with MEGATHERM*



Thin case contour hardening of gear teeth with controlled depth of hardness has been made possible by the use of MEGATHERM induction heat.

The hardened surface completely follows the tooth and root contour of the gear with the core still in its original state, as shown plainly by this microphotograph. This 0.005 case was applied to gears of 24 D.P. —51 teeth—2.125 P.D.—2.208 O.D. and S.A.E. 4140 steel in 1/4 of 1 second with a 25 KW MEGATHERM—5 megacycle energy doing the job.

These long wearing contour hardened gears become an automatic production item with MEGATHERM.

Write *today* on your company letterhead for data on MEGATHERM.

Federal Telephone and Radio Corporation

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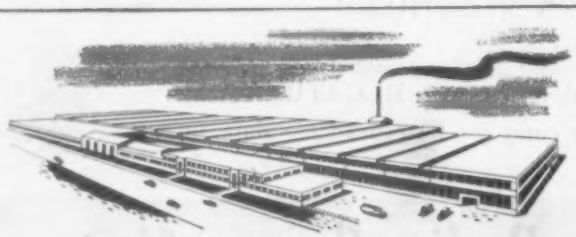
AN IT&T ASSOCIATE

Newark 1, N. J.

This huge marine cargo drive is typical of the unusual machining and assembly jobs that are handled every day at Warren City. One of the best-equipped heavy steel fabricating plants in the world, Warren City's facilities include more than 600 separate pieces of large-capacity equipment. These include planers, shapers, milling machines, lathes, boring mills, drills, cranes, automatic welders, grinders, flame cutting machines, stress-relieving furnaces, and extensive facilities for X-ray and other types of testing. Send for our illustrated brochure, "Men, Machines and Management for Heavy-Industry Jobs," with complete listing of the facilities and equipment in our huge plant at Warren, Ohio. Located in the heart of the Cleveland-Pittsburgh industrial area, Warren is on main or connecting lines of four major railroads.

NEED A LIFT ON YOUR HEAVY STUFF?

IF IT'S STEEL—and you can *move* it—we can make it! Our seven-million-dollar plant in eastern Ohio is one of the most modern and complete shops in America for the fabricating, welding, machining and assembling of heavy machinery, parts and equipment. Our experience in the advanced welding techniques which have been developed during the war has already proved highly valuable to our customers. Our ability to re-design heavy steel castings into practical modern weldments has effected great savings in weight, bulk and cost, in addition to substantial gains in strength, production speed, freedom from flaws, and ease of testing. If you have a problem that weldments might solve, or a heavy job of any kind that your own plant is not now in position to handle, put the matter up to our staff of practical-minded engineers. They'll gladly study your needs and give you their recommendations, without obligating you in any way.



WARREN CITY MANUFACTURING COMPANY ★★★

DEPARTMENT E

WARREN, OHIO

Wholly Owned Subsidiary of

GRAHAM-PAIGE MOTORS CORPORATION

GET THE extras WITH SAFETY GRINDING WHEELS

Many makes of wheels, as you know, do a grand grinding job with minimum grinding cost. SAFETY Grinding Wheels, of course, are in this class. But SAFETY Grinding Wheels go much further than that, and give you important extras that add to their value.

You get almost "tailor-made" wheels—specific wheels for specific jobs. Next, if you wish it, you get the benefit of the wide experience of SAFETY engineers who will gladly analyze your foundry operation, with a view to increasing output and cutting cost for the competitive era ahead.

Select the grinding job that gives you the most trouble, and ask for one of our engineers to analyze the job in relation to one of our wheels.

For more of the facts, contact our factory, or one of the offices listed below. There will be no obligations.

SAFETY

GRINDING WHEEL AND MACHINE COMPANY

Main Office and Factory SPRINGFIELD, OHIO, Phone 4631

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★ Pittsburgh—ATlantic 5218 ★ Erie—23-093 ★ Philadelphia—WAlnut 3132 ★ St. Louis—CEntral 3676
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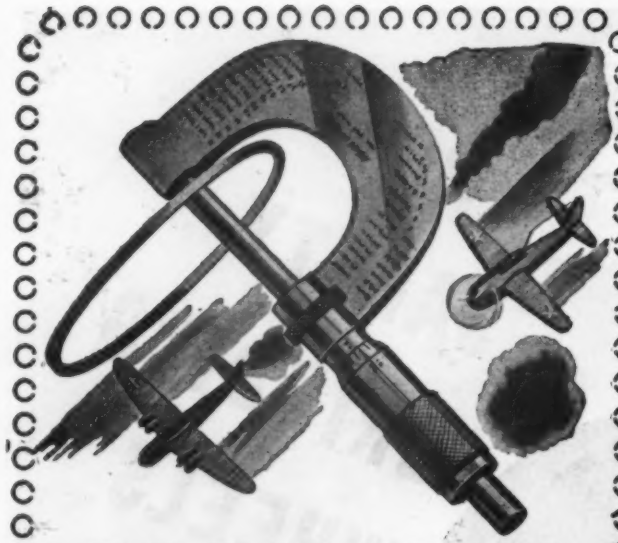


PRECISION
where it counts!

The margin between victory and disaster to the fighter pilot depends upon that all important factor — precision. Likewise today's demands on marking equipment are for precision — plus speed. With a background of continuous pioneering and development since the beginning of this century, Noblewest equipment is today foremost in the field of high-speed precision metal marking. Our new catalog supplement No. 43 describes Noblewest Marking Machines and Methods that meet practically all requirements of industry. Write for it today.

NOBLE & WESTBROOK MFG. CO.

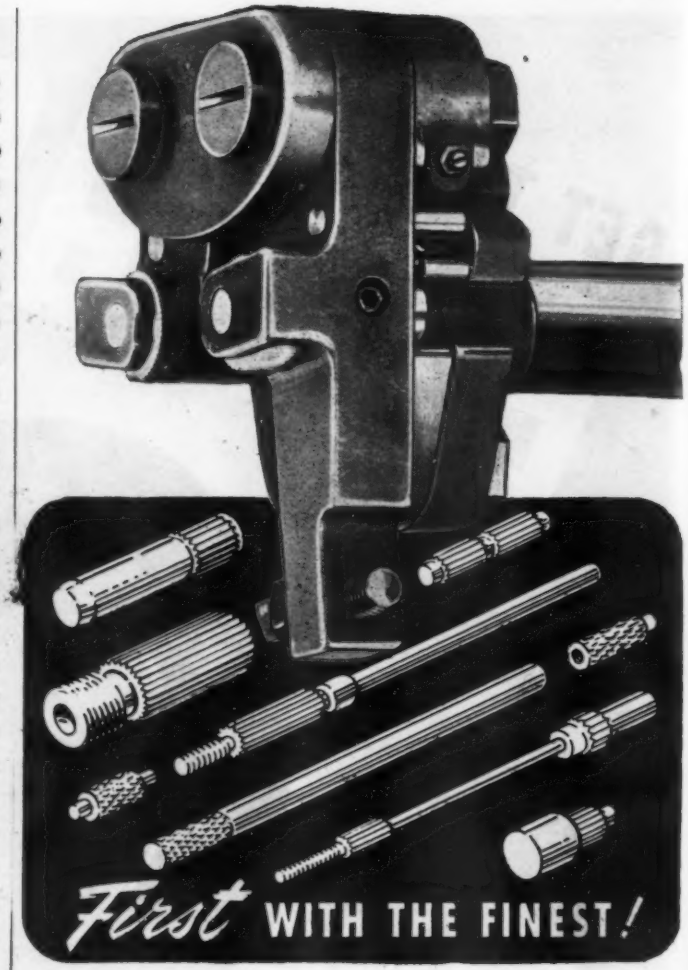
Marking specialists since 1904

EAST HARTFORD, CONN.

MODEL 183

Designed for marking P & W Aircraft Engine piston rings where dispersion of thickness must be held to within .001 of an inch. Will mark off sizes of rings up to 6" and can be retooled for marking other flat parts of uniform thickness at rapid production speeds.

MARK IT BEST WITH NOBLEWEST® NOBLEWEST IMPROVED MARKING DEVICES



MODEL K

Knurling Tool

FOR TURRET TYPE SCREW MACHINES

A New Screw Machine Tool of outstanding design and construction making it possible to perform many of the knurling jobs formerly considered impossible with tools of other types.

Built on a new principle, operated from the turret, with feed and pressure equally applied simultaneously to both sides of work. Speedy in operation, giving clean, accurate knurling in a minimum of time.

Sturdily built with the usual Boyar-Schultz quality of precision manufacture.

Be Sure to Write for New Detailed Circular

BOYAR-SCHULTZ
CORPORATION
2109 Walnut St. · CHICAGO 12, ILLINOIS

TOOL STEEL

To be careful in your selection of tool steels is to ensure maximum service on the job. Midvale tool steel experience is both long enough and wide enough to add certainty to our recommendations — and to merit a confidence, already long established. A wide variety of both common and special grades of tool steel are Midvale-made; and our technical staff is always ready to assist in the proper choice. All the usual grades and sizes are carried in our stocks — and can be shipped at once.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
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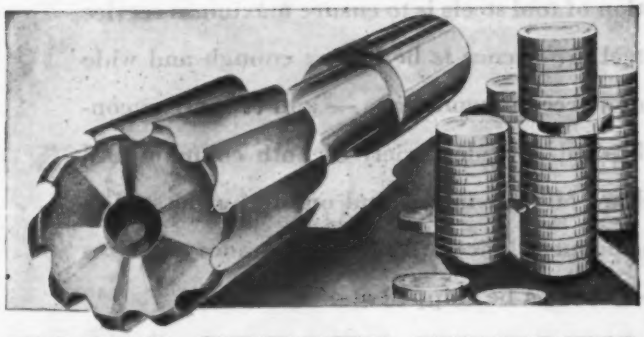
MIDVALE

Custom Steel Makers to Industry



TOOLS CREATE WEALTH

Why not decide to get more and better work out of tools, to meet keen competition?

Take advantage of treatments available here which often improve tools 30% to 60% or more. We have specialized in tool treating for a quarter-century. The war has brought new and better methods for original hardening, and also for supplementary treatings of tools purchased in a hardened, finished condition.

Now is the time to investigate. Let us show you how other manufacturers have already benefited.

More than half the tools now in common use can be treated so they will run longer between grinds, hold size better, and produce a smoother finish.

Our **"SILVER FINISH"** is bright, clean hardening

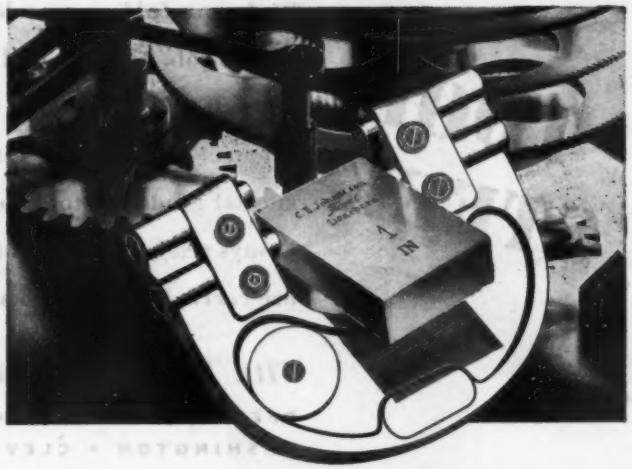
Our **"NUSITE"** means harder, tougher cutting tools.

Our **"AD-LIFE"** improves the tools you buy outside.

Write for booklet, **"FIFTY FACTS"** *. . . It tells what other manufacturers did to improve tool quality and life.*

BETTER HARDENING — BETTER RESULTS

PERFECTION
TOOL & METAL HEAT TREATING CO.
1740-58 WEST HUBBARD STREET CHICAGO 22 ILL



"JO-BLOCKS" GUARD THOUSANDS OF FAMOUS PRODUCT-REPUTATIONS

A list of manufacturers using genuine Ford Johansson Gage Blocks would include a high percentage of industrial leaders . . . and many who will join the ranks of leadership tomorrow.

For the use of measurement standards of Jo-Block accuracy (4 or 8 millionths of an inch, plus or minus) is a pretty sure indication of determined intent to build a reputation for product-excellence.

Order a master set of Jo-Blocks and Accessories for your plant. We predict you will be very glad you made the moderate investment. Write for new catalog No. 17. Address—FORD MOTOR COMPANY, Johansson Division, Dept. 19, Dearborn, Michigan.

Ford Johansson GAGE BLOCKS

UNIVERSAL'S SPANNER WRENCH

THE UNIVERSAL TOOL!

This newest and finest of maintenance tools is a self-compensating wrench, offering a wide range of adjustments, imparting uniform pressure at geometrically spaced points with positive holding action *yet* eliminating distortion or crushing of even the softest metals.

This versatile tool does the work of a multitude of solid type Spanner Wrenches—and saves space, weight and costs in service kits for assembly stations or maintenance shops.

Made of the finest hardened alloy, and chrome molybdenum steel for toughness and durability, this wrench will withstand high leverage factors and give years of service. It is manufactured in three sizes, covering spanner nut diameter ⅜" to 1¼"—1¼" to 3"—3" to 5".

Write for full information to
General Sales Offices, 415 Book Building, Detroit 26, Mich.

The Universal Engineering Co.
2230-32 NATIONAL AVE. SAN DIEGO 2, CALIFORNIA

FILE MASTER

(Trade Mark Reg.)

FOR
HAND WORKING
OF
PLASTICS
and NON-FERROUS METALS
LOW TEMPERATURE and FREE CUTTING CHARACTERISTICS

Engineering Sales ANDERSON, INDIANA

HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to HELL

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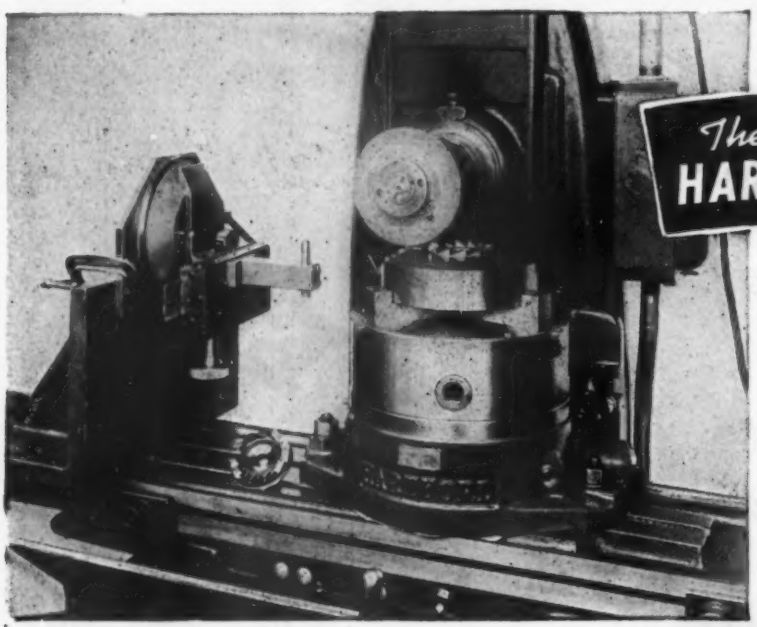

Hartford Super-Spacer used in a grinding operation. After the teeth of the part shown are roughed and hardened, this operation with the Super-Spacer grinds the surfaces to a close radial tolerance. Indexing is extremely fast and accurate.

The HARTFORD SPECIAL MACHINERY CO.
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The experience of countless users discloses the fact the Hartford Super-Spacer is a tool of exceptional value for the rigid control of accurate machining operations within its scope.

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With its attachments and fixtures, the Super-Spacer is adaptable to milling, drilling, grinding, jig boring and slotting, at speeds and feeds limited only by its holding capacity and the power of the machine.

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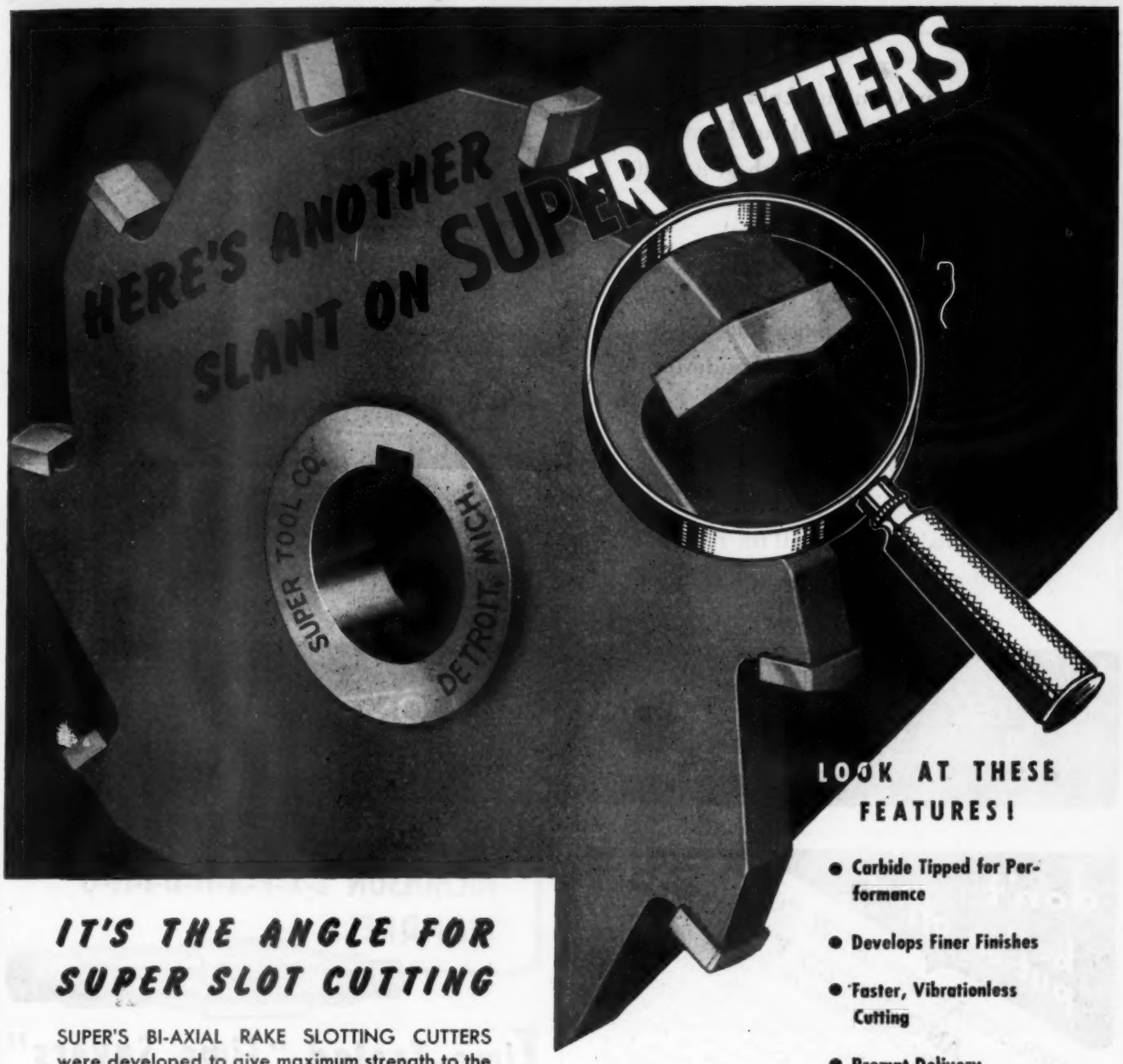

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- **Develops Finer Finishes**
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Here is a striking example of high production grinding. These deep-groove ball bearing outer races with 1.8504 O.D. were ground on a No. 16 Automatic Blanchard Surface Grinder at the rate of 3100 per hour

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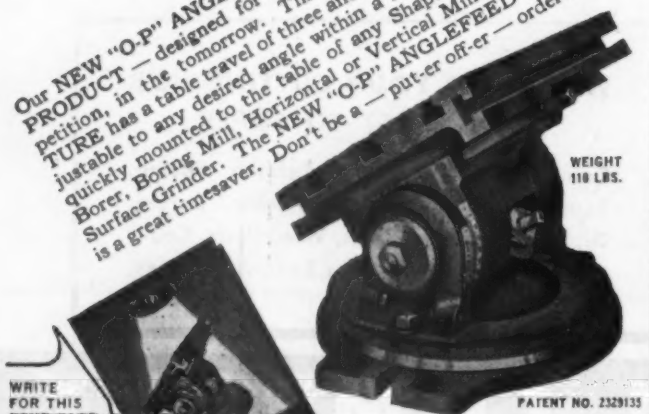

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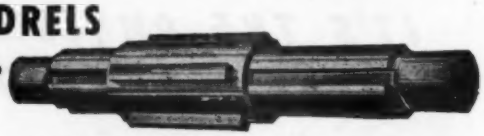

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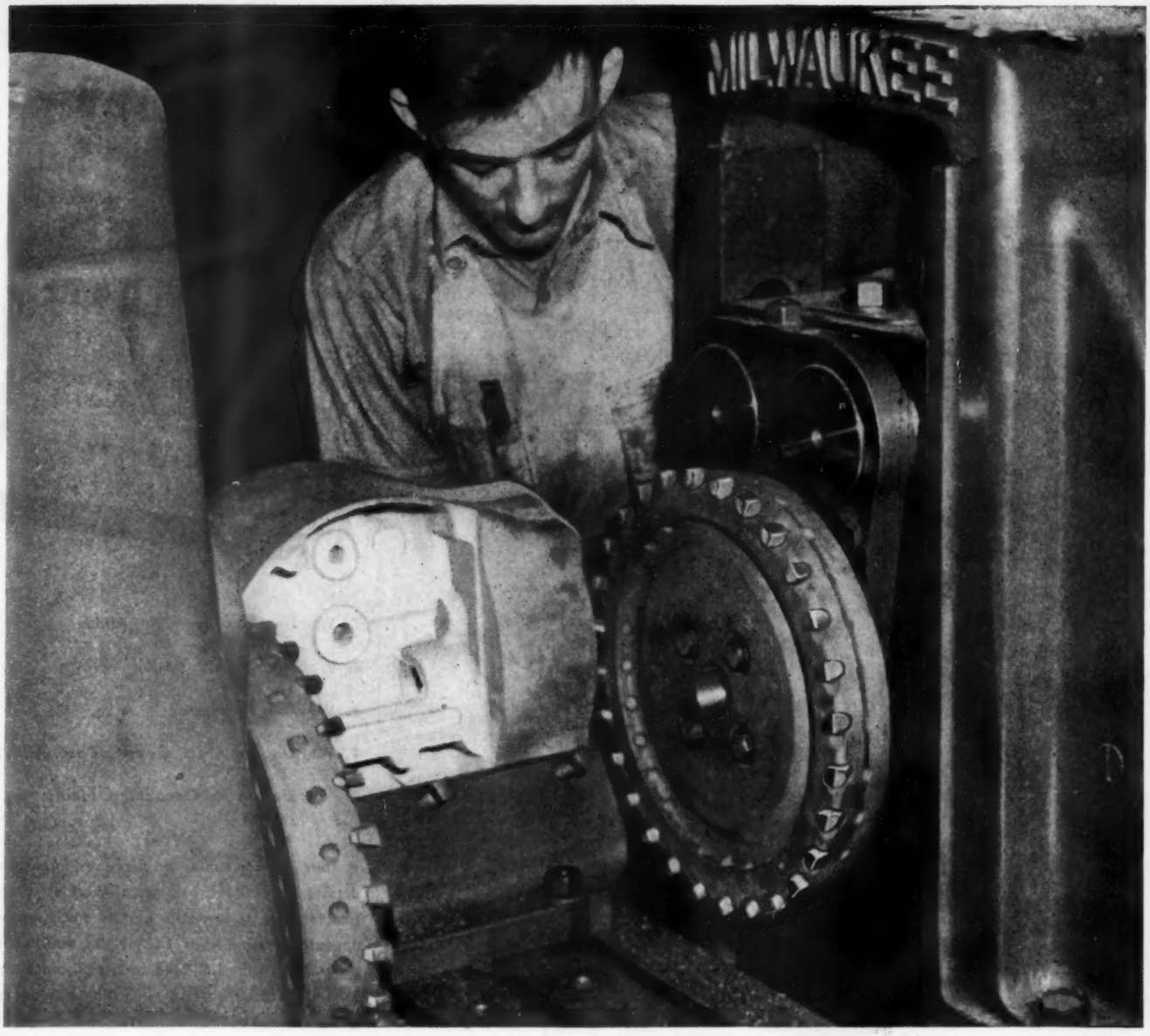

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Tool popularity goes with ability to produce consistently—easily—accurately. This, plus positive-locking blades, has made the Lovejoy Type "A" face mill a favorite in production plants and tool rooms requiring *medium duty* cuts. All blades are *positive-locked* in the forged steel housings at the correct cutting angles. This eliminates breaking stresses, and gives exceptionally free cutting qualities. Lovejoy blades of HSS, tungsten carbide, and cast alloy are interchangeable over a wide range of sizes. Shell end, Type "A" cutters are available for National Standard and Lovejoy Standard arbors, and the Type "A" can be supplied for any spindle mounting. For full information, prices, and specifications on the Type "A" and all other Lovejoy milling cutters, boring heads, boring bars, etc., write for Catalog No. 27.

LOVEJOY TOOL COMPANY, Inc., Springfield, Vt.

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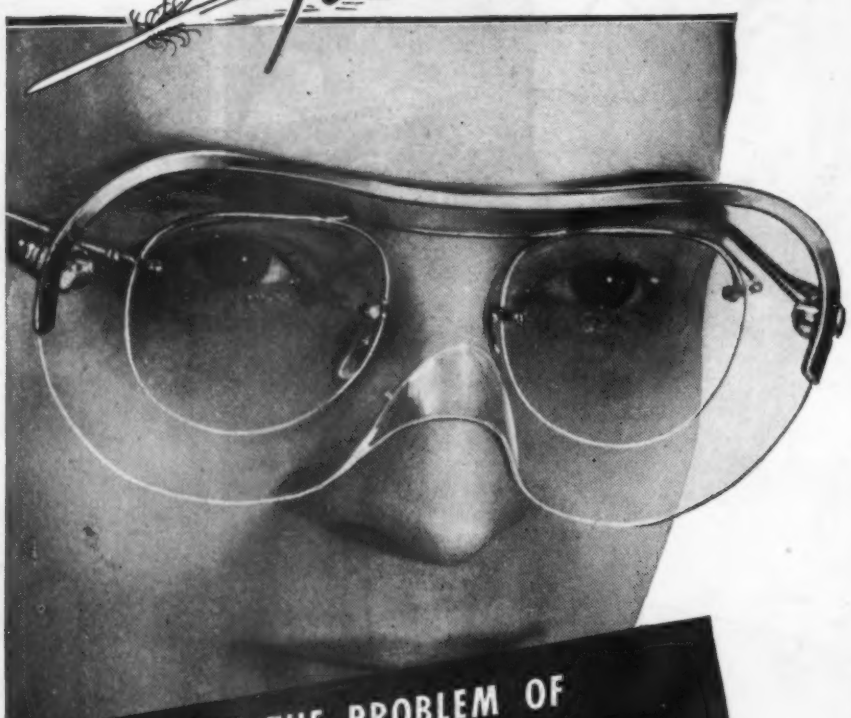

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HOW COULD HE GET PULLED OVER THAT WAY. WHEN TH' MACHINE RUNS THE OTHER WAY?
IT USED TO BE A DISGRACE TO GET CAUGHT IN A MACHINE WHEN THEY WAS EASY TO GET CAUGHT IN--NOW WITH THEM MADE SAFE, YOU'RE A KIND OF HERO!
IT WASN'T TH' MACHINE'S FAULT-- STEPPED RIGHT INTO THAT OIL--SLID RIGHT INTO TH' MACHINE! NOW MEBBE WE'LL GET SPEEDI-DRI!
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WE HAVE HUNDREDS of letters like the above in our files. Many plants, where oil and grease used to make floors slippery and dangerous, are now ordering SPEEDI-DRI by the carload.

SPEEDI-DRI is successful because it does the job and it's easy to use. It's safety's magic carpet. It's an oil-thirsty, granular material that soaks-up oil or grease from any kind of floor. SPEEDI-DRI is non-inflammable and fire-retardant. It will help prevent dermatitis caused by oil-soaked shoes. It eliminates complicated cleaning-machines, or trained workmen. You just spread SPEEDI-DRI wherever oil or grease accumulates. It soaks-up the oil and grease. Then you sweep it up with a broom.

One plant took fourteen men off floor-maintenance when they found SPEEDI-DRI.

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At $27.50 a barrel, that's $275 worth of cutting oil saved per day—with an equipment investment of less than $1500!

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- Reclaims more than 90% of cutting oil from metal chips and machine turnings.
- Only 3 minutes or less operating time per load.
- Cuts coolant costs, saves valuable oil.
- Increases scrap value of machine turnings.
- Simple, safe and easy to operate—no skilled labor required.
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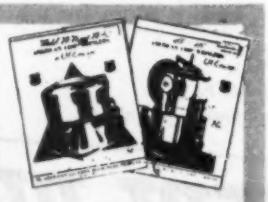

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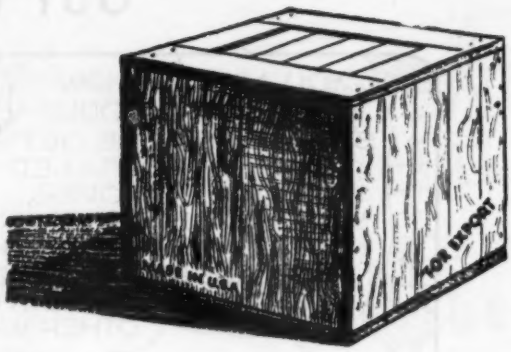

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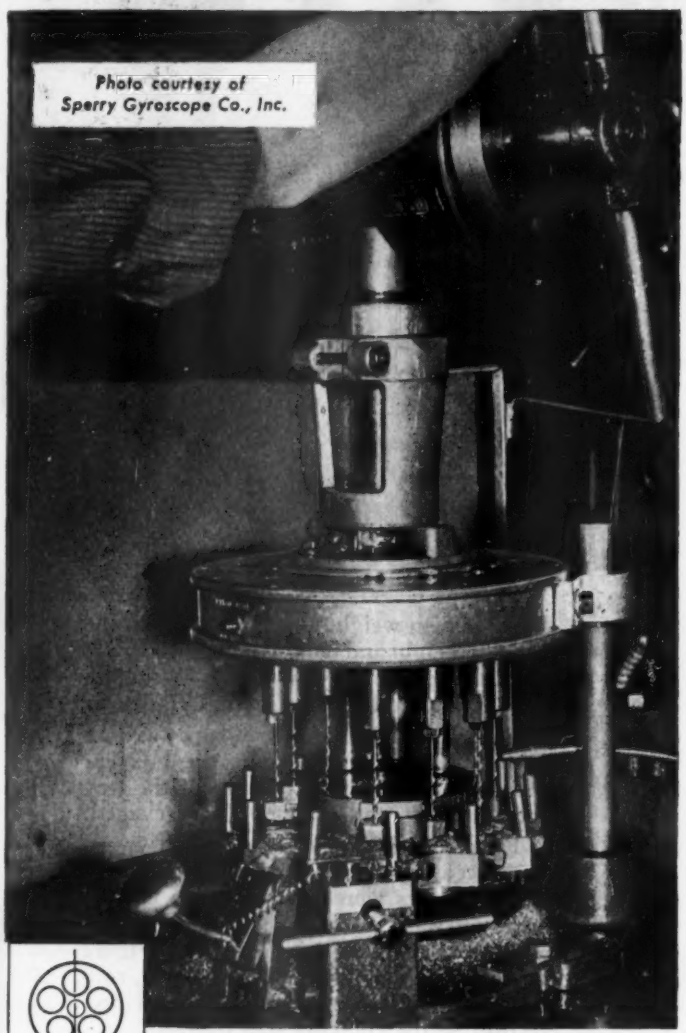
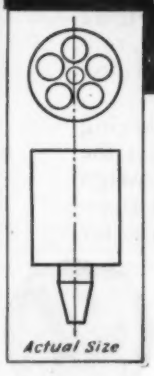
500% jump in drilling production with MULTIPLE SPINDLE DRILLING HEADS





Ettco-Emrick Multiple Drilling Head on standard drill press simultaneously rough and finish drilling 5 holes in chrome carbon steel pivots. Rough drill size is .120", with .005" removed on redrill. The Ettco-Emrick Indexing Fixture, which is tied in with the Head like a punch and die, is a big factor in making fast production possible.

The remarkable accomplishment of the Sperry Gyroscope Co. in producing the vast numbers of gyro-instruments demanded by the war effort, has been made possible by Sperry's skillful organization of production plus the use of time and labor saving equipment.

Among the latter are Ettco-Emrick Multiple Spindle Drilling and Tapping Heads. Typical of the production increases achieved with these Heads is the job illustrated—the rough and finish drilling of 5 holes in a chrome carbon steel pivot.

The production rate on this job, as formerly done on two single drill stands, was 100 pivots per 8-hour shift. With Ettco-Emrick Heads it's 600 per shift—a sweet jump of 500%.

CONSULT ETTCO *on your small parts drilling and tapping*—Ettco-Emrick Multiple Heads assure top production on such jobs. And they actually cost you *nothing*—because they *pay back* their purchase price in quick time by their savings in man-hours and machine-hours. Send a drawing or sample part for Multiple Head recommendations.

ETTCO TOOL CO.

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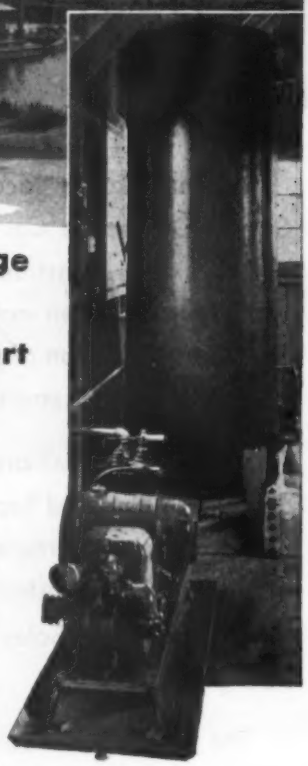
Over 25 years specialization in solving industry's drilling and tapping problems

CURTIS Dependability Scores Again



Giant Army Dredge Relies on Curtis Compressor to Start 320 H.P. Diesel

This new ASD Hydraulic Dredge, built by American Steel Dredge Company for the U.S.A. Engineer Corps, is designed to operate in isolated locations for long periods. Its power plant cannot fail.

A Curtis Air Compressor maintains a minimum of 200 lbs. pressure in a large air storage tank, used to start the main Diesel Engine which is directly connected to the dredging pump.

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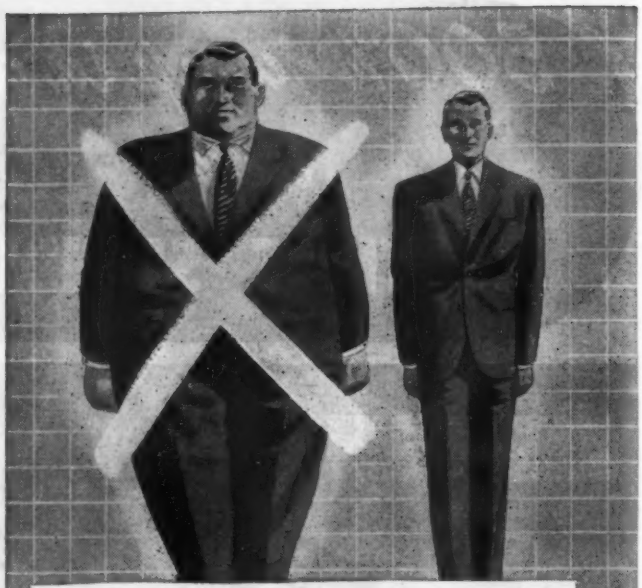

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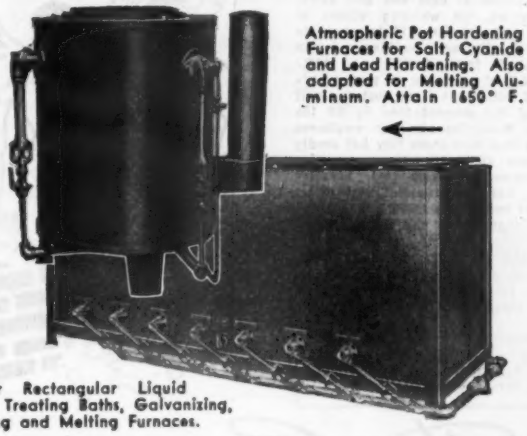

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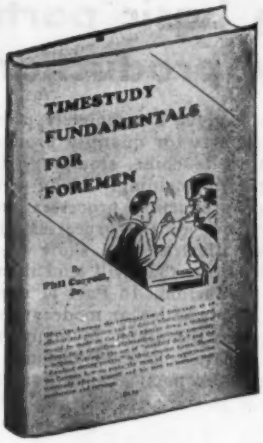

Stressing exactly the problems the foreman encounters in making a timestudy and in applying new, improved standards, this straightforward manual shows just how to go about making the study, tells what to do in order to get the most out of the study, in bigger and better output and in improved working methods.

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By PHIL CARROLL, JR.
Management Consultant

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Here are the same methods used by up-and-coming modern industries—the same procedures condensed and simplified and brought by a timestudy expert to the man who wants to get more production on a down-to-earth practical scientific basis.

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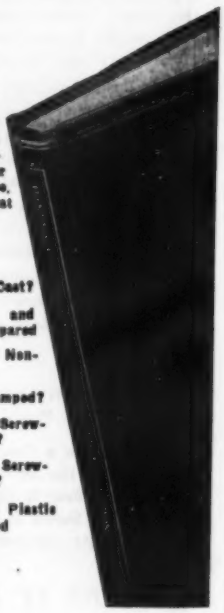

Chapters

1. Design of Die Castings
2. Design of Sand Castings for Quantity Production
3. Design of Screw Machine Products
4. Design of Stampings
5. Design of Die Forged Parts for Quantity Production
6. Notes on and Accomplishments in Hot Heading
7. Notes on the Design of Cold-headed Parts
8. Design of Plastic Moldings for Economical Quantity Production
9. Die Cast or Sand Cast?
10. Permanent-mold and Die Castings Compared
11. Which Type of Non-ferrous Casting?
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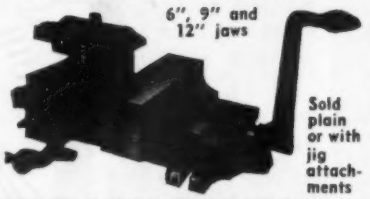
It is made flush, parallel and square. Stood on side or end, or fastened against angle plate, it gives accurate basic positioning. Numerous fixtures make it a many-purpose jig or fixture for repeat-operation work.



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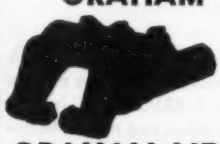

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We can build machines and parts, special tools and fixtures of all kinds to your specifications and design. Skilled workmen and modern equipment are your guarantee of satisfaction. The design and building of wire and ribbon stock forming machines are our specialty.

We solicit your blueprints or samples for quotation. No obligation of course.

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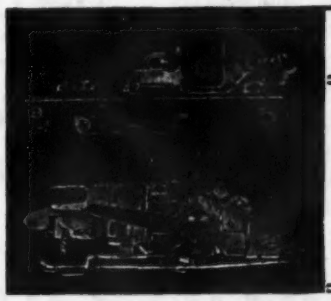

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We can make long or short runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. Our manufacturing facilities also include screw machine products, tools, dies, jigs and fixtures.

Your order is assured of quality workmanship by skilled mechanics. We will furnish prompt quotations on your blueprints or samples. Write us today!

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THE GREIST MFG. CO. 546 Blake Street New Haven, Conn.

AVAILABLE SCREW CAPACITY

¼ to 4½ Automatic and Hand Screws

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WANTED—WORK (PEACETIME) ON CONTRACT BASIS TO YOUR SPECIFICATIONS

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Fully equipped, modern machine shop with complete production setup for all types of machine work.

Send blueprint or sample for prompt quotation without obligation.

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WIRE AND METAL SPECIALISTS

in round, flat, square and special shaped wire in all metals.

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Long runs for Turret Lathe & Milling Machines.

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Specializing in molds for the Rubber Industry also facilities for automatic screw machine work up to 11/16.

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For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us — we will take care of them

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Lucas THE LAST WORD IN REBUILDING MACHINE TOOLS

Take this trip through the Lucas Plant-ON PAPER

It may be impossible for you to visit this home of precision-workmanship in rebuilding machine tools . . . so we have opened our doors to you on paper. Step in—and see the results of 35 years of experience in this field. See how we completely disassemble and clean machines . . . supply NEW PARTS when needed. See our skilled craftsman using the latest machines to renew and modernize . . . the constant precision checkups and re-checkups, the testing under power . . . all those things that mean a GOOD JOB. Here is a visual trip through the Lucas Plant, from front office to shipping room—you'll enjoy. May we send you a complimentary copy?

THIS is the seventh in a series telling the story behind the LUCAS nameplate on machine tools.

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J. L. LUCAS & SON, INC. BRIDGEPORT 5, CONN.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

POSITIONS VACANT

WANTED EXPERIENCED machine tool designers and detail draftsmen. Apply by letter giving full information of training, experience and salary required. WMC rules apply. Giddings & Lewis Machine Tool Co., Fond du Lac, Wisconsin.

WANTED: TOOL DESIGNERS. Graduate engineer or equivalent, specific experience in design of tools, fixtures, gages, etc., for manufacture of small interchangeable metal parts and a definite interest in design problems. Good post-war prospects. State age, marital status, details of education, experience, draft status, present salary and expected salary. Enclose recent photograph or snapshot. Applicants must be able to obtain statement of availability. Remington Arms Company, Inc., Personnel Relations Division, Bridgeport, Conn.

WANTED

MACHINE DESIGNERS

Experienced on the design of special machinery. Excellent opportunity for first class men interested in steady positions.

Only men 35-55 with a record of successful achievements will be considered. In replying furnish information preliminary to a conveniently arranged interview.

THE TAFT-PEIRCE MFG. CO.
Woonsocket, R. I.

WANTED: GUN Designers. Graduate engineer or equivalent, thoroughly trained in the fundamentals of merchanical engineering and in the design and development of sporting arms or small interchangeable metal parts. Ability to recognize and analyze weaknesses in design of mechanisms and invent simple, sturdy substitutes. Ingenuity and a liking for sporting arms are desirable. Good post-war prospects, state age, marital status, details of education, experience, draft status, present salary and expected salary. Enclose recent photograph or snapshot. Applicants must be able to obtain statement of availability. Remington Arms Company, Inc., Personnel Relations Division, Bridgeport, Conn.

WANTED: MACHINE Design and development engineers. Graduate engineer or equivalent, experienced in the design and development of automatic and semi-automatic machines concerned with manufacture of sporting arms and sporting arms ammunition or with manufacture of small interchangeable metal parts. Creative ability and initiative are essential and a sound training in economic evaluations of manufacturing processes. Good post-war prospects. State age, marital status, details of education, experience, draft status, present salary and expected salary. Enclose recent photograph or snapshot. Applicants must be able to obtain statement of availability. Remington Arms Company, Inc., Personnel Relations Division, Bridgeport, Conn.

WORKS MANAGER for machine tool rebuilding plant. Expansion plans include special machinery manufacturing. Engineering and management qualities and machine tool experience required. Modern plant. Progressive management. Pleasant Eastern location. P-401, American Machinist, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 365)

WANTED

MACHINE DESIGNER

For equipment development department of well-established electronic and metallurgical products manufacturer. Must be capable of designing production equipment and carrying through development projects. Permanent position, with excellent opportunities.

P-411, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED

TOOL DESIGNER AND DRAFTSMAN to take charge of drafting room for firm employing 300 people, manufacturing precision line of hot upsets, hot forged bolts, drop forgings, and turret lathe parts. Must have thorough knowledge of processes such as heading, threading, milling, turning, etc. Must be willing to spend at least half of time on board designing tools and fixtures. Minimum requirement of 6 years daigning and planning experience. Contact A. J. Reynolds, Rhode Island Tool Company, 148 West Rivert Street, Providence, Rhode Island.

Additional Employment Ads on pages 365, 366, 368 & 370

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
(Not available for equipment advertising)
10 cents a word minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.
PROPOSALS, 50 cents a line an insertion.

INFORMATION:
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

DISPLAYED RATE:
The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M. September 12th will appear in the issue of Sept. 27th subject to limitation of space available

POSITIONS VACANT

(Continued from page 364)

GEAR ENGINEER who is familiar with all types of gears and gear machines. P-431, American Machinist, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. Postwar plans are creating lifetime opportunities now. This thoroughly organized confidential service of 35 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Several weeks are required to negotiate and each individual must finance the cost of his own campaign. Retailing fee protected by refund provision. Identity covered and present position protected. Plan now for post-war security. Send only name and address for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

EXECUTIVE WITH diversified experience in machine work, metal stamping, welding, gray iron casting and assembly. Have been in charge of design and construction of tools, dies, jigs, fixtures and special machinery for the past 3 years. Graduate Mechanical engineer. Age 47. Healthy and very active Machine Tool work, Chief engineer and /or master mechanic position desired. Or what have you to offer PW-375, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

DEVELOPMENT ENGINEER (M.E.) Five years in research department large industrial concern developing new automatic production machinery, additional five years development work on mechanical and hydraulic presses and automatic container machinery. Experienced in supervision and shop methods. Analysis and theory a speciality. Responsibility essential. Age 33. PW-376, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SALES ENGINEER—Age 49, experienced in sales, design and manufacture of all types of tooling. 12 years' experience with carbide tooling. Has practical shop and sales executive experience. PW-394, American Machinist, 330 W. 42nd St., New York 18, N. Y.

CHIEF ENGINEER. Eighteen years of broad experience in developing and designing portable pneumatic and electric tools, small electric driven mechanisms and light machine tool equipment. Electrical and mechanical engineer. College graduate, age 42. Experience includes product, tool and machine design. Practical man well versed in modern industrial designing. A chief engineer's position is desired with a small to medium size plant manufacturing light industrial equipment or similar line. PW-404, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER desires contracts to design automatic machinery. Thoroughly experienced in production equipment, package and high speed tobacco machinery, press work and hydraulic machinery. I am also prepared to have designs manufactured and do necessary work to insure satisfactory results. PW-417, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PRODUCTION ENGINEER or sup't. 20 years' experience as tool design, planning, production control and supervision, desires permanent position with responsible manufacturers. Min. salary $600. PW-403, 520 N. Michigan Ave., Chicago 11, Ill.

(Continued on page 368)

MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS

Engineers experienced in Machine Design and Sheet Metal Products or Household Appliances.

Must have successful pre-war background. Permanent position with large, progressive organization. In replying give full particulars, places worked, projects, etc.

Institute of Product Research
Dept. LAH—448 S. Hill Street
Los Angeles 13 California

Tool Room Superintendent

A well established progressive company requires the services of a qualified Toolroom Superintendent. Essential requirements are an engineering background and a minimum of 10 yrs. diversified practical experience in the manufacture of small interchangeable dies and tools.

He should have the ability to plan and direct results and secure results economically. The company is nationally known and is engaged in the manufacture of small metal articles. Location near New York City.

Age 40-50; Write fully giving details of experience, education and salary requirements.

BOX 18, REALSERVICE
110 W. 34th St., N. Y. 1, N. Y.

WANTED

TOOL AND DIE MAKERS—experienced on all types blanking, forming, and progressive dies.

MACHINISTS—with experience in all around machine and tool work, and tool grinding.

HEAT TREATER—with experience on heat treating tools and dies.

Permanent full-time employment with excellent working conditions in one of the South's leading plants. Our company is at present time on vital war work, but we have a splendid postwar future. We will assist in securing living facilities.

KANOY AND SONS MACHINE COMPANY
4111 Thrift Road Charlotte, N. C.

WESTINGHOUSE ELECTRIC CORPORATION

needs two experienced plant planning and materials handling engineers. Adequate salary and assured future for the right man. Wire or write Supervisor, Technical Employment, 306 Fourth Avenue, Pittsburgh, Pennsylvania, for application.

WANTED — SHOP SUPERINTENDENT FOR MACHINE TOOL PLANT — 400 MEN

Man under 45 with active experience in machine tool shop to assume full responsibility for quality and quantity production in modernly equipped shop manufacturing a line of heavy grinding equipment.

Must have proven ability to organize and maintain all departments for manufacturing at a high point of efficiency. Also would be expected to maintain labor relations which have always been very good.

Post war outlook excellent. Permanent position with long established manufacturer willing to pay good salary to one qualified and can deliver. Location small midwestern town with excellent living conditions.

State age, training, background, shop experience and salary expected. Confidential.

P-413, AMERICAN MACHINIST
520 NORTH MICHIGAN AVENUE CHICAGO 11, ILL.

Additional Employment Advertising on pages 366, 368 & 370

WANTED
ENGINEERS
MACHINE DEVELOPMENT

Graduate engineer or equivalent, experienced in the design and development of special and experimental machines. Men with creative ability required, experienced in such lines as automatic, semi-automatic, or ordnance equipment. Must be thoroughly acquainted with modern methods and shop practices and capable of developing new ideas in conjunction with modern mechanical laboratory facilities.

State age, marital status, details of education, experience, draft status, present salary and salary expected. Enclose recent photograph or snapshot.

Post-war opportunity.

Applicants must be able to obtain Statement of Availability.

E. I. du Pont de Nemours & Company, Inc.
Personnel Division
Wilmington 98, Delaware

Design Engineer

Age 35 to 50; must possess thorough knowledge in the design of precision automatic machines and accept responsibility for planning and designing equipment leading to greater mechanization of production operations.

Sr. Tool Engineer

Age 35 to 45; Must be experienced in the design and development of small interchangeable tools and dies. Creative ability required. Practical toolroom experience is an essential qualification.

Engineer Checker

Age 35 to 45; Graduate engineer experienced in checking intricate precision machine and tool designs. Should have designing and practical shop experience.

These openings are with a well established and progressive organization engaged in the manufacture of small metal articles to close tolerances and offer unusual opportunities for men with executive ability and initiative. Plant located near New York City.

Write fully giving details of experience, education and salary requirements.

BOX 246, REALSERVICE
110 W. 34th St., N. Y. 1, N. Y.

Factory Superintendent

A well established progressive firm requires the services of a qualified executive to take charge of production. Essential requirements are a sound engineering background and experience in mass production of small metal articles to close tolerances. He should have the ability to plan and direct quality production, secure results economically and have the knack of getting others to work with him and for him.

Our company is nationally known, is located nearby New York City, has modern plant facilities and offers a real opportunity and future for the right man. Age about 40-50.

Write fully giving details of your experience, education and salary desired.

BOX 151, REALSERVICE
110 W. 34th St., N. Y. 1, N. Y.

WANTED
PRODUCTION MANAGER

Man experienced in planning, scheduling machine loading and inventory control with experience in small lot production. Machine Shop and sheet metal experience an asset. Prefer man looking for post war security rather than salary.

P-335, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

Chief Research Engineer

A well established and progressive organization located nearby New York City, engaged in the mass production of small precision metal articles needs an eminently qualified man age 40 to 50, to head up its Research Department.

This man must be capable of heading a research organization dealing in mechanical, metallurgical and electro-chemical problems; preferably one with wide experience in the mechanical field. He must have already demonstrated ingenuity, inventiveness and executive ability.

Write complete details of experience, education and salary requirements.

BOX 219, REALSERVICE
110 W. 34th St., N. Y. 1, N. Y.

Development Engineer

Graduate engineer or equivalent experienced in designing and development of small precision die casting dies for high speed production. He must be thoroughly acquainted with modern diecasting methods and practices. Knowledge of recent developments in plastics desirable. Practical toolroom experience is an essential qualification. Unusual opportunity for one who possesses executive ability and initiative.

Our company is well established and engaged in the mass production of small metal articles at close tolerances. Location of plant near New York City.

Age 35 to 45. Write in detail stating experience, education and salary requirements.

BOX 199, REALSERVICE
110 W. 34th Street, N. Y. 1., N. Y.

WANTED
INDUSTRIAL CONTROL ENGINEER

We are interested in securing an electrical engineer to develop industrial control apparatus.

Applicant should be familiar with competitive designs, and have working knowledge of tests and working methods. Underwriter's requirements and NEMA standards for electric motor control.

Excellent opportunity to qualify for a permanent supervisory position in Engineering Department of an expanding organization well established in the automotive electrical and magnetic relay field. In applying give age and complete resume of experience.

R-B-M MANUFACTURING CO.
Division Essex Wire Corp.
LOGANSPORT INDIANA

WANTED
CHIEF INSPECTOR

Man experienced in inspection of all types of precision gears. Must be familiar with all types of checking equipment and well grounded in gear cutting. Write fully giving details of experience, education and salary requirements.

P-396, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

TOOL DESIGNERS

Should have experience designing Jigs, Fixtures, Stamping Dies, Plastic Molds, Gages, Cutting Tools, etc. on small precision parts. Must be experienced in one or more of the above classifications. Large well established N.E. Ohio manufacturer now fully engaged in vital war work. Excellent post-war opportunities. Living conditions good in small town or near by medium sized city. W.M.C. rules and regulations apply. If qualified address replies to

P-378, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

WANTED
ASSISTANT GENERAL MANAGER

Man experienced in all phases of precision gear cutting in small well-equipped plant. Excellent opportunity for man with all-round gear experience. Write fully giving details of experience, education and salary requirements.

P-397, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

Additional Equipment Advertising on pages 368 & 370

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

AUTOMATICS

6—#61 New Britain-Gridley 6 Spindle 1⅝" cap. Automatic Screw Machines. A.C. Motor Drive, Threading Spindle.
1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.
1—#515 National Acme 4-Spindle Automatic.
2—#55 National Acme 1⅝" 4-spindle Automatics, complete.
1—#2G Brown & Sharpe Automatic.
1—#1 Brown & Sharpe Automatic, old style.

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
Horiz. #36 Landis-Rochester, 3½ Bar Floor Type—Floor Plate 72" x 120".
42" Bullard Vertical Boring Mill with side head; New Era Type.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Bickford 4-spindle Rail Drill, #4 Morse Taper. Table 20" x 67".
Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle.
Woodward & Rogers, 6 spindle.
Fosdick 13", 4 spindle (2). 2 spindle (1).

RADIAL DRILLS

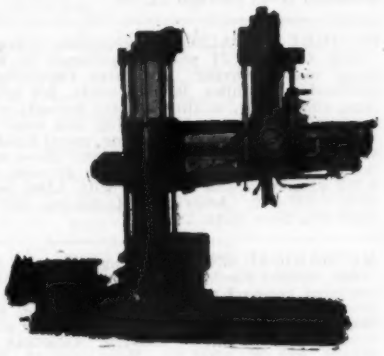
3' 9" col. American, S.P.D.
3' Dreses, 10" rd. col. QCG., M.D.
5' Arm 13" Rd. Col. Cinn. Bick. air clamp.
6' Arm 14" Col. Cincinnati Bickford.

GRINDERS

12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
14"x36' Cincinnati, Plain, motor in base.
6"x32" Norton Cyl., overhead c/s drive.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
3—#2 Cincinnati Centerless Grinders.
1—12x12x24 Thompson Hydraulic Surface Grinder, Nearly New.
1—4x12 Landis Hydraulic Cylindrical Grinder, New.

Blanchard Grinder #16, 30" dia. Magnetic Chuck, 25 HP 3-60-440 V. Motor.

Pratt & Whitney Vertical Surface Grinder, 14"x36" with 10"x36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.



Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

LATHES

14 x 6 Pratt & Whitney semi—Q.C.G.
16 x 8 Hendey Arranged M.D., Taper
16" Warner & Swasey Fox Brass (2).
16" Dreses Fox Brass.
Putnam, 26 x 12 Heavy Q.C.G., arr. for M.D.
Potter & Johnston #6A Automatic Chuckers; 3½" dia. hole in spindle (2).
14 x 6 Hendey Toolroom Lathe, G.H., M.D.
14x8 LeBlond Toolroom Lathe, cone drive.
14" x 6' Hendey 12-speed geared head, motor in base.

MILLING MACHINES

#3, #4, #5 Cinn., High Power, Plain, S.P.D.
No. 0 Bickett Vertical Bench Miller.
#1-#1½-#2 Brown & Sharpe Plain Millers.
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
No. 8 Lees Bradner Thread Miller.
#1-#2—Kempsmith Plain Milling Machines

PLANERS

120"x72"x35' Betts, 4 Heads, M.D.
48"x48"x12' Putnam Heavy, 2 Heads, M.D.
30"x30"x12' American M.D., 2 Heads.
30"x30"x10' Cinn. Heavy Pattern, 2 Hds.
20"x20"x24" N.-B.-P., Planer Shaper, M.D.

POWER PRESS HEADQUARTERS

#4½ Bliss D.C. B.G. Forging 3" stroke.
#1, Bliss-"Stiles", Plain flywheel.
#35 Niagara back flywheel, geared.
#22 Wells, back flywheel. Open back.
200 ton A.C.F. Hydraulic Press. Bed 24"x 36", 4-post.
7—25 ton Model SL2 K.R. Wilson hydraulic Presses.
Beck Duplex Embossing Press.
75 ton H.P.M. 2 post, Hydraulic Press.
#1 Bliss Straight Side, double action, Cam Press. Will draw and lift out 2¾".

SHAPERS AND GEAR CUTTERS

15' Potter & Johnston Crank Shaper, universal table.
26" Cincinnati Triple Geared, Belt Dr.
12" Schuchart & Schutte Gear Hobber.
#1 Adams Gear Hobbers, Belt driven (3).
#13 Brown & Sharpe Spur & Bevel Gear Cutter.
24" Potter & Johnston Crank Shaper, universal table, power feed to head.

SHEARS & METAL CUTTING MACHINERY

Lennox Splitting Shear, ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Niagara #98 Production Power Brake & Folder. 72"x14 ga. cap. Equal to new.
Bliss #232 Slitting Shear, 14 ga.
Gould & Eberhardt Slitting Shear, 10 ga.
Niagara 16 ga. x 42" Gap Foot Shear.
Niagara #9S Power Seamer.
Niagara 4"x42" Geared Slip Roll Former.
Niagara 3" x 36" Geared Slip Roll Former.
Niagara 48" Roller Leveller. 6 Roll.
Niagara #30 Beader & Flanger.
Niagara #0 Beader.
Niagara #4-E Squaring Shear, 48" x ¼" capacity, M.D.

MISCELLANEOUS

Waterbury-Farrel Cold Header, double stroke, open die, ½" cap. & 6'.

Manville Cold Header, single stroke, solid die, 3/16" cap.

J. C. Miller Co. Lacq. Heater with acquistat.
Heat Treating Furnaces for the tool room.
Sleeper & Hartley #1 Wire coiling machine for making BX cable.
50 K.W. Moesta Gun Welder Transformer, portable, 25 cy. 440 volts.
Hydraulic Pumps—Hele Shaw, Racine, Oil Gear, Motor Driven.
Blake and Knowles 12x2x12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
#228C Greenlee Vertical Hollow Chisel Mortizer, Power feed, M.D.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½". New this year.
Standard Automatic Drop Hammer, 300#.

BUY FROM STOCK
Telephone
MAIN 6347-6348

FALK
MACHINERY COMPANY
Machinery Merchants

18 WARD ST.
ROCHESTER 5
N. Y.

SEARCHLIGHT SECTION

WANTED

MECHANICAL ENGINEER

Must be thoroughly experienced in all gear manufacturing problems as well as designing; only those with extensive gear experience need apply. Exceptional post-war opportunity. Write full history including name of university and year graduated; names and addresses of all former employers; age; salary desired.

P-345, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER

Wanted by an Eastern Manufacturer of Dyeing and Processing Machinery. Prefer man about 35 to 45. Should be a graduate mechanical engineer with several years shop experience, must be a good organizer and well versed in modern shop and sheet metal practice. To take complete charge of Engineering Department with a force of 6 to 8 men. Submit an outline of your qualifications.

P-414, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

METAL SPECIALIST

Well-known national concern manufacturing materials used in processing, maintenance and cleaning operations has opening for man who has had good experience in problems of metal shaping, forming and finishing operations. Splendid opportunity now and in post-war period. Location New York, some traveling. Give full details of age, experience, salary, etc. If data indicates necessary experience, interview will be arranged at our expense.

METAL SPECIALIST, Box 567 Church St. Annex, N.Y.P.O.

PROFESSIONAL SERVICES

Contract Termination Specialists
CONSULTANTS, ADVISORS, NEGOTIATORS
We will assume full charge of your TERMINATED WAR CONTRACTS
Govt. Trained—Our charges included in post termination expenses.
ROBERT L. COLLUM ASSOCIATES
Room 837 11 West 42nd St., N. Y., N. Y.

POSITIONS WANTED
(Continued from page 365)

JR. EXECUTIVE (32) background includes all phases of metal fabrication and assembly. Experienced with processing methods, standards planning, quality and production control. Present position as ass't. to superintendent of aircraft factory. PW-418, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

FACTORY MANAGER or production executive. Age 44, with 21 years' experience in metal goods manufacturing. Extensive knowledge of production planning, layouts, costs, job evaluation, time study, quality control inspection and personnel management. Jobbing and mass production operations, heat treating, metal finishing, assembly and tool room operation. Have excellent rating for management of division with 3,200 employees and company with 1,500 inspectors. PW-419, American Machinist, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER, age 42, with tools, dies, special machine design experience, method engineer, research and development engineer with proved supervisory ability along the lines referenced above, desires supervisory position with a progressive company. PW-420, American Machinist, 330 W. 42nd St., New York 18, N. Y.

IF YOU can use executive secretary, female, who is also experienced in pricing, orders, routing; unusual ability, honest, loyal and aggressive, with pep and personality; 13 years' experience in industrial and technical lines. Location immaterial. PW-428, American Machinist, 330 W. 42nd St., New York 18, N. Y.

EXECUTIVE AVAILABLE

Experienced as draftsman, designer of tools, special machines and products, machinist, tool maker, assistant chief engineer, selling and sales supervision, office management, cost accountant. Graduate mechanical engineer and served time as tool maker. Last position over seventeen years as general manager of small company on light manufacturing with an extremely successful record on production and sales on a profit producing basis. Best of references available. Seeking broader opportunities and will consider only responsible position with progressive company. Minimum salary $12,000 with opportunity to participate in profit or cost improvement produced.

PW-426, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

EXECUTIVE AVAILABLE CANADA

Desires connection with progressive United States company who contemplates establishing Canadian plant or who has one that is not operating to their complete satisfaction. Graduate mechanical engineer, tool-maker, machinist, designer of tools, special machines and products. Successful record in selling, sales supervision, cost accounting, office and factory management. Very successful record as manager of Canadian plant with best of references available. Over twenty years with last company and seeking broader opportunities. Only responsible position with progressive company will be considered where broad practical experience can be used.

PW-427, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

TOOL AND Die expert seeks position as foreman for toolroom or toolroom production. Age 52, 32 years' experience in designing and making special tools and machines for production. PW-421, American Machinist, 330 W. 42nd St., New York 18, N. Y.

REPRESENTATIVES AVAILABLE

EXPORT SALES Engineetr. Machine tools, machinery, engineering prducts. Twenty years domestic and foreign selling experience. In contact with all important foreign buying and export problems and finance, also substantial foreign manufacturing facilities if required. Now free to represent manufacturer or corporation. RA-405, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SALES EXECUTIVE or representative, single, top notch, versatile, worldwide traveled, linguist, bondable, conservative, available. Crown, 168 W. 77th Street, N. Y. C.

GRADUATE ENGINEER, twenty years equipment and mill supply sales, desires additional lines for Southwest area. Acme Engineers, Box 5155, Houston 12, Texas.

BUSINESS OPPORTUNITIES

MACHINE SHOP, well equipped, established many years serving logging, sawmill, and farming area, Western Oregon college town. Columbia Engr. Co., Porter Bldg., Portland 4.

WANTED a factory well financed to build and sell royalty basis new invention to sort fruit, vegetable, etc. BO-422, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

CURTIS & CURTIS pipe threading and cutting off machine line for sale, with rights to manufacture, use of name, drawings, parts and correspondence. BO-423, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington 5, D.C.

DO YOU WANT A REPRESENTATIVE IN HOLLAND?

ENGINEER

with long pre-war sales experience, formerly in executive position with large printing press concern, good background in advertising, sales promotion, 1st class connections, now in Holland, desires to represent firm manufacturing machines and/or tools. Best references.

Contact Dr. Ernest E. Rothe, 252 West 73rd St., New York 23, N. Y., or write or cable W. I. Rothe, Hatertscheveldweg 318, Nymegen, Holland

WANTED

PRODUCTS FOR NATIONAL OR REGIONAL DISTRIBUTION

Nationally established manufacturer of special tools and precision gages has adequate sales organization for the distribution of related, but non-competitive items to all industries using perishable tools, gages and machine tool specialties.

Can be arranged on national or regional basis, with special facilities in the Detroit area. Reply in detail to

RA-416, AMERICAN MACHINIST
520 NORTH MICHIGAN AVENUE CHICAGO 11, ILLINOIS

(Additional Selling Opportunity Advertising on page 370)

READY FOR YOUR RECONVERSION NEEDS IN STOCK FOR IMMEDIATE SHIPMENT

HORIZONTAL MILLING MACHINES

No. 2L Cincinnati Universal, m.d. in base, latest type
No. 2A Brown & Sharpe Universal, m.d.
No. 3A Brown & Sharpe Universal, m.d.
No. 4K Milwaukee Universal, m.d. in base, latest type
No. 000 Brown & Sharpe Plain, m.d., latest type
No. 2L Cincinnati Plain, m.d., latest type
No. 2B Brown & Sharpe Plain, m.d. in base, double overarm
No. 3B Brown & Sharpe Plain, m.d.
No. 3B Milwaukee Plain, double overarm, m.d.
No. 3K Milwaukee Plain, m.d. in base, latest type
No. 4K Milwaukee Plain, m.d. in base, latest type
No. 4H Milwaukee Plain, m.d. in base, late type
No. 4H Milwaukee Universal, m.d. in base, late type
No. 4 Cincinnati Plain H.P., m.d.
No. 5B Heavy Brown & Sharpe Plain, m.d.
No. 4B Brown & Sharpe Plain, m.d. in base
No. 5 Cincinnati Plain H.P., m.d., latest type

VERTICAL MILLING MACHINES

No. 2M Cincinnati, m.d. in base, latest type
No. 2 Brown & Sharpe, s.p.d.
No. 1 Beman & Smith Combined Vertical & Horizontal
No. 3 Cincinnati H.S. Dial Type, m.d., latest
No. 3 Cincinnati, m.d.
No. 3B Milwaukee, m.d. in base
No. 3B Milwaukee, m.d.
No. 3V Toledo, s.p.d.
No. 4 Cincinnati H.P., m.d.
No. 4 Cincinnati H.P., m.d., latest type
No. 4 Cincinnati H.S. Dial Type, m.d., latest
No. 5 Brown & Sharpe, cone
No. 5 Jackson, m.d.
No. 5 Reed-Prentice, m.d., latest type
No. 6 Becker, cone
2 spindle Newton, m.d.

ENGINE LATHES

10"x20" Pratt & Whitney Bench, m.d., latest type
10"x3½' South Bend Bench 1" collet cap., m.d., latest
12"x8' Lodge & Shipley Selec. Hd., m.d. in base
14"x6' American Geared Head, m.d.
14"x8' Pratt & Whitney, cone
14"x8' Pratt & Whitney, cone
16"x6' Lodge & Shipley, cone
18"x8' Lodge & Shipley, Selective Head, m.d., taper
18"x72" centers Monarch BB Geared Head, m.d., latest type
18"x96" centers Monarch Geared Head, m.d., taper, latest type
18"x120" centers Monarch Geared Head, m.d., taper, latest type
18"x102" centers Lodge & Shipley Selec. Head, m.d., latest type
18"x18' Lodge & Shipley Selec. Head, m.d., taper
20"x12' Springfield Geared Head, m.d.
20"x8' Lodge & Shipley Selec. Head, m.d., taper
22"x16' centers (22' bed) American 100 H.P. Input Super Lathe, with 100 H.P. D.C. motor, latest type
24"x16' New Haven, cone
24"x30' Schumacher-Boye, cone
26"x12' Schumacher-Boye, cone
27"x16' LeBlond, cone
27"x18' LeBlond Type C Geared Head, m.d.
30"x12'6" Niles-Bement-Pond Geared Head, m.d.
30"x13'6" Niles-Bement-Pond Geared Head, m.d.
30"x26' Lodge & Shipley Selec. Head, m.d.
30"x28' (20' centers) Niles "Time Saver" m.d., latest type
36"x10' Putnam, motorized
36"x12' Wright, cone
36"x14' Boye & Emmes, cone
36"x20' American Geared Head, m.d.
36"x24' American Geared Head, m.d., 2 carriages
36"x28'6" (20' centers) Niles Heavy Duty, m.d., p.r.t., latest type
36"x28'6" (20' centers) Niles Heavy Duty, m.d., p.r.t., taper, latest type
36"x36'6" (28' centers) Niles Heavy Duty, m.d., p.r.t., 2 carriages, latest type
42"x26' American Geared Head, m.d., p.r.t.

MANUFACTURING LATHES

No. 9 Heavy LeBlond Multi-Cut, m.d.
17"x124" centers LeBlond Rapid Production Geared Head, m.d. in base, latest
3½x36", 3x80" LoSwing, s.p.d.
8x84" LoSwing, m.d.
8x132" LoSwing, m.d., latest type
13x24" Coulter Automatic Threading, m.d.
15"x6' Automatic Threading
20"x8' LeBlond Mfg. Type, m.d.
20"x16' American Geared Head, arr. for spindle boring
No. 5 Niles 42x96" Center Drive Car Wheel Lathe, m.d., new
Niles-Bement-Pond Quartering Machine, m.d., new

RADIAL DRILLS

3' American Sensitive
3' Fosdick Sensitive
3½' American Triple Purpose Plain, m.d.
3½' Cincinnati-Bickford Plain, m.d.
4' American Triple Purpose Plain, m.d. on arm
4' American Triple Geared Plain, m.d.
4'—15" column Cincinnati-Bickford Super-Service Plain, m.d. on arm
4' Cincinnati-Bickford Plain, gear box, 32 speeds
4' Cincinnati-Bickford Plain, m.d. on arm
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared Plain, m.d.
5' Carlton Plain, gear box m.d.
5' Cincinnati-Bickford Plain, m.d.
5' Cincinnati-Bickford Plate Driller, m.d.
5' Dreses Plain, gear box
5' Prentice Plain, m.d.
6'—17" column American Hole Wizard, m.d., latest type
6' American Hole Wizard, m.d., with railroad type base, latest type
6' Niles-Bement-Pond Semi-Universal, m.d.
6' Cincinnati-Bickford Full Universal, m.d.
6' Reed-Prentice Plain, m.d.
6' Western Plain, m.d.
7' Cincinnati-Bickford Plain, m.d.
8' American Triple Purpose Plain, 16" column, m.d. on arm
10'—22" column American Triple Purpose Plain, m.d. on arm

UPRIGHT DRILLS

22" Barnes All Geared—Self-Oiling
30" Rich H.D., m.d.
32" Aurora
H3 Barnes Hydram, m.d.
No. 221½ Barnes All Geared, tapper

HAMMERS

200 lb. Beaudry, m.d.
400 lb. Bliss Board Drop, belt
800 lb. Bement Single Frame Steam
1100 lb. Bement Miles Single Frame Steam

GEAR CUTTERS & HOBBERS

No. 12 Barber-Colman Double Overarm Gear Hobbers, m.d.
6" Gleason Straight Bevel Gear Generator, m.d.
8" Gleason Mfg. Type Straight Bevel, m.d.
11" Gleason Straight Bevel, m.d.
12" Gleason Straight Bevel, m.d.
9" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
10" Pratt & Whitney Spur & Spiral Hydraulic Gear Grinders, m.d.
No. 3-26", 3-36", 4-36", 8-60" Brown & Sharpe Spur Gear Cutters
48" Cleveland Gear Hobber, m.d.
No. 71 Fellows H.S. Gear Shaper, m.d.
Cincinnati Gear Burnisher, m.d.
Gleason Spiral Bevel Gear Rougher, s.p.d.
No. 2HS Lees-Bradner Spur & Helical Gear Grinder, m.d.
No. 13LS Fellows Gear Lapper, m.d.
No. 36B Gould & Eberhardt Spur & Bevel Gear Cutter, m.d., latest type
No. 36-S Gould & Eberhardt Spur Gear Cutter, m.d.
No. 61 Fellows Gear Shaper, belt
No. 64-S Fellows Gear Shaper, m.d.
Cross Gear Tooth Rounder, m.d.

VALVE SEAT GRINDER

Cincinnati Valve Seat Grinder, m.d., cap. ⅜" valve stems

CYLINDER GRINDERS

No. 55 Heald, m.d.
No. 55 Heald, belt
No. 60 Heald, belt
No. 65 Heald, belt

CYLINDRICAL GRINDERS

6x18" Landis Plain Self-Contained, m.d.
6x32" Norton Plain. m.d.
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis Plain Self-Contained, m.d.
10x36" Cincinnati Plain Hydraulic, m.d., model EA
10x48" Brown & Sharpe Plain, belt
10x48" Landis Type C Plain Hydraulic, m.d.
10x72" Landis Plain Self-Contained, m.d.
12x36" Cincinnati Plain, belt
12x36" Modern, belt
12x48" Cincinnati Plain Self-Contained, m.d.
12x48" Modern Plain, m.d.
12x72" Brown & Sharpe Plain, belt
12x96" Landis Plain Self-Contained
14x18" Cincinnati Plain Self-Contained, m.d.
14x48" Cincinnati Plain Self-Contained, m.d.
16x216" Landis Type B Plain Hydraulic, m.d., latest type
20x120" Landis Plain Self-Contained, with gap, m.d.
26x96" Landis Plain Self-Contained, m.d.
16x72" Landis Plain Self-Contained, m.d.

UNIVERSAL CYLINDRICAL GRINDERS

No. 2—12x30" Brown & Sharpe, belt
12x36" Cincinnati, belt
14x48" Cincinnati Model EA, m.d., latest type
16x68" Landis, belt

INTERNAL GRINDERS

No. 16—16" Bryant, m.d., latest type
No. 16RS-16 Bryant, m.d., latest type
No. 16—22" Bryant, m.d., latest type
No. 6, 10, and 20 Bryant, belt
No. 24—20" Bryant, m.d., late
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Gagematic, m.d.

SURFACE GRINDERS

No. 3 Gallmeyer & Livingston, m.d., hydraulic
No. 500—170" Hanchett Surface, m.d.
14" Pratt & Whitney Vertical, ball bearing, m.d.
22" Pratt & Whitney Type B, m.d., late type
38"x38"x12' Gray Planer Type, m.d.
No. 1 Fraser Lapper, 26" plate
No. 33 Abrasive Vertical, m.d. in base
54" Bridgeport Knife, belt
Baldwin-Tuthill Knife, 76"
Builders Iron Fdry. Co., m.d.

TOOL & CUTTER GRINDERS

D6A Gallmeyer & Livingston Drill, m.d.
No. 2 Cincinnati Universal Tool & Cutter, m.d.
Gisholt Universal Tool, belt
Gleason, Cutter, belt
Gould & Eberhardt Gear Cutter, belt

More than 1200 machines in stock at our Cincinnati Warehouse
1000-1034 Tennessee Ave., Cincinnati, Ohio. Telephone MElrose 1241

Send us your inquiries

***New York Branch*—Chrysler Bldg.—Telephone MUrray Hill 4-4246**

THE EASTERN MACHINERY CO.

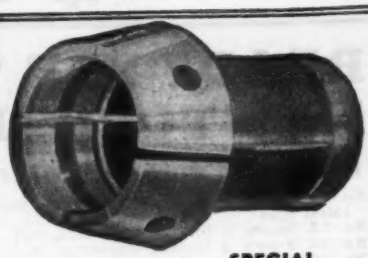
1004 TENNESSEE AVE. **CINCINNATI 29, OHIO**

WANTED SALES ENGINEERS

To represent a modern gear manufacturing plant. Must have a degree in mechanical engineering as well as extensive selling experience in the gear industry. Write full details including name of university and year graduated; names and addresses of former employers; salary and territory desired and other pertinent details.

SW-410, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

USED COLLETS
FEED FINGERS — PADS



ACME, No. 515, No. 52, No. 53, No. 54, No. 55, No. 56.
ACME-GRIDLEY 1⅜"
Cleveland ⅞" to 2½".
Cone 1¼", 1½", 2½", 4".
Foster No. 1, No. 2, No. 3, No. 4, No. 5, No. 7.
Gridley, Models F, ¾", ⅞", 1¼", 1⅜", 2¼", 2⅜", 3¼", 4¼".
⅞ Model "G" Gridley Form, Lead and Cut Off Cams.
No. 4 No. 6 Warner & Swasey.
Bardons & Oliver, Brown & Sharpe, Davenport, Garvin.
LARGE STOCK OF ⅜x5 NEW BRITAINS.
Change Gears, Lead Cams, Form Cams, No. 53 to No. 56 Acme.
Spindle gears, finger holders, collet tubes, push tubes, spindles, nose pieces for 2⅜" F Gridley.
Large stock 1⅜" F. Gridley Collets.

SPECIAL
10 x 5 Brown & Sharpe Face Mill Cutters. Vertical Head for large mill.

MONA

GRAFF MACHINE TOOL COMPANY
7140 S. Halsted Street — Vincennes 9664 — Chicago 21, Ill.

MANUFACTURERS REPRESENTATIVES

An old well established Precision Machine Tool Manufacturer desires representatives in principle localities. Please write.

LATHAM MACHINE COMPANY
6636 Kelly St. — Pittsburgh 6, Pa.

SEND FOR OUR SPECIAL PRICES OF PRECISION TAPPER GROUND TAPS

High speed tapper taps, bent and straight shank. Sizes ranging 3/56 to 10/32 in 90° bent shank. Sizes ranging ¼-28 to ½-20 NF in 90° & 180° bent shank. Sizes ranging ¼-28 to ¾-16 in Acme and straight shank 15" overall. ALL GOOD STANDARD BRANDS FOR IMMEDIATE DELIVERY.

DE WITT TOOL COMPANY
173 GRAND STREET, NEW YORK 13, N. Y.
SEND US YOUR INQUIRIES

TECHNICAL SALES AND SERVICE REPRESENTATIVES

Men under 45 years of age with previous sales or service experience and knowledge of manufacturing operations or mechanically inclined. Several established territories including some in mid-western location. Men must be able to relocate. Car essential. Trained in New York at our expense to qualify in use and servicing of our cleaning, drawing, stamping, cutting and rust-proofing materials. Excellent opportunities for right men now and in post-war period as our organization sells to and serves practically every type of industry. Attractive compensation arrangement. Give full details of age, experience, etc. Replies treated confidentially.

SW-412, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

UNIVERSAL TOOLS!
NATIONALLY ADVERTISED BRANDS AND PRICES
If It's A Tool—We Have It, Can Get It, or It Isn't made! PRICE LIST & ORDER BLANK FREE!!
UNIVERSAL TOOL COMPANY
O. B. Demattois, President
1527 Grand A.M. — Kansas City, Missouri.
Immediate Shipments: Overnight by Air: To Anywhere—U.S.A.

WANTED POST WAR PRODUCTS TO MANUFACTURE

Well equipped metal manufacturing and fabricating plant of 25 years' experience, with skilled personnel capable of accurate design and production work, desires to contact parties who have machine parts or machines to manufacture.

WHALEY ENGINEERING CORP.
P.O. Box 1336 — Norfolk 1, Va.

WANTED BY MANUFACTURER MACHINERY NEW OR USED GOOD CONDITION

- #2 Brown & Sharpe Milling Machine
- #2 and #5 Brown & Sharpe Surface Grinders
- #3½C Bliss Press
- 750-lb. Pneumatic (Double Action) Drop Hammer
- Bridgeport Milling Head
- #215 Bliss (4" Stroke Single Action) Presses
- #215 Bliss (5" stroke Single Action) Presses
- Anderson Hydraulic Straightening Press
- 1" Capacity Drill Press
- Magnus Rotary Drum Washing Machine
- Magnus Mesh Belt Washing Machine—Machine must have mesh belt (top and bottom) to hold parts in spray while washing
- Bench Comparator (Jones-Lamson type)
- Rotary Dryer for Plating Line
- Atlas 12-Ton Arbor Press

Reply in detail

W-425, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

SALES REPRESENTATIVES WANTED

Established speed reducer, precision cut gear, special drive and special parts manufacturer wishes to add a few established sales representatives.

Men selected will be paid on commission basis, must own auto and maintain office.

Our products are extensively advertised, and our post war developments will afford the right people opportunities of great scope.

RW-424, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

WANTED
WATERBURY FARREL FOUNDRY EYELET MACHINE. 8-8 or 10 PLUNGER.
Wire Collect to
VIRJUNE MACHINE COMPANY
23 Jefferson Street — Waterbury 40, Conn.

WANTED BY
SMALL BOLT & NUT PLANT
COLD HEADERS—DOUBLE STROKE—BOLT TRIMMERS — ROLL THREADERS — SCREW SLOTTERS—#2 Surface Grinder—Power Feed
Must be late machines in excellent condition. Give full particulars, including price.
W-415, AMERICAN MACHINIST
330 West 42nd St., New York 18, N. Y.

Don't forget the
BOX NUMBER
When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

IMPORTANT NEWS FOR MACHINE TOOL BUYERS

We can again offer *Engineered Rebuilt* and guaranteed machine tools at a saving of 40% or more. Our stock, as always, is of the highest grade. We list below some outstanding items in our Albany Plant.

BORING MILLS

24" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

42" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

66" NILES - BEMENT - POND Vertical Heavy Duty Tire Boring and turning Mill with two swiveling heads. AC or DC motor drive.

NO. 1 PUTNAM Vertical Car Wheel Boring Mill with side head for hub facing and hoist. AC or DC motor drive.

48" NILES-BEMENT-POND Car wheel Boring Mill with hoist. AC or DC motor drive.

96" NILES-BEMENT-POND Vertical with two swiveling heads, Power Rapid Traverse. AC or DC motor drive.

120" BETTS Heavy Vertical with two swiveling heads, Power Rapid Traverse, AC or DC motor drive.

120" NILES-BEMENNT-POND Vertical with two swiveling heads, Power Rapid Traverse. AC or DC motor drive.

120" CINCINNATI Massive Pattern Vertical with two swiveling heads, Power Rapid Traverse. AC or DC motor drive.

10'-16' CINCINNATI extension Type Vertical with two swiveling heads, Power Rapid Traverse. AC or DC motor drive.

5½" BAR NILES-BEMENT-POND Heavy floor Type Horizontal Boring, Drilling, Milling Machine. AC or DC motor drive.

RADIAL DRILLS

4' AMERICAN Plain Triple Purpose Enclosed head drill with tapping attachment, Single pulley belt drive or AC or DC motor drive.

5½' AMERICAN Full Universal Triple Geared with tapping attachment. Single pulley belt drive or AC or DC motor dr.

6' CARLTON Plain 15" round column with DC motor on arm, tapping attachment.

7' AMERICAN Full Universal converted to motor drive with motor on arm. AC or DC motor drive.

8' NILES-BEMENT-POND "Right Line" Plain with 230 volt DC motor on arm, tapping attachment.

LATHES

16"x8' LEBLOND Back Geared, 56" between centers, belt feeds. Belt drive through five stop cone and countershaft.

16"x8' AMERICAN 8 speed geared head, 54" between centers, taper attachment, 5HP AC or DC motor.

27"x12' AMERICAN 8 speed geared head, 96" between centers. AC or DC motor drive.

42"x36' PUTNAM Geared Head, 25' between centers. Quick change gear box. AC or DC motor drive.

48"x30' BRIDGEFORD 9 speed geared head, 20' between centers. Triple geared internal face plate drive. AC or DC motor.

48"x20' NILES-BEMENT-POND Extra Heavy Geared Head, 11'5" between centers. Power cross and angular feed to compound rest. Semi-quick change gear, taper attachment.

48"x59' BRIDGEFORD Boring and Turning with 9 speed geared headstock, turning carriage with compound rest, AC or DC motor drive.

NO. 4 PUTNAM Extra Heavy Center Drive Axle Turning Lathe with two carriages. AC or DC motor drive.

27" SWING 98" CENTERS BRIDGEFORD Plain Turning Lathe for car axles or heavy forgings, two carriages and tool rests. Single pulley belt drive or AC or DC motor drive.

42" PUTNAM Heavy Double End Car wheel lathe. Equipped with overhead hoist for loading wheels and axles.

MILLERS

NO. 3B BROWN & SHARPE Plain with double overarm table 14"x60" with 7½ HP, AC or DC motor.

NO. 3 KEARNEY & TRECKER Plain, dial type feeds. Power rapid traverse, table 16"x60", AC or DC motor in base of column.

NO. 4 CINCINNATI High Power Plain. Power rapid traverse table 16½"x64". Single pulley belt drive or AC or DC motor drive, vertical attach.

NO. 5B BROWN & SHARPE Plain, Power rapid traverse, table 22"x81". AC or DC motor drive.

NO. 4 CINCINNATI High Power Vertical, Power rapid traverse. Table 16½"x 64". Single pulley belt drive or AC or DC motor drive.

NO. 10 NILES-BEMENT-POND Extra Heavy Vertical with 42" diameter power feed rotary table. AC or DC motor drive.

24"x24"x12' INGERSOLL Horizontal Spindle Slab Miller with adjustable rail, table 24"x12'. AC or DC motor drive.

30"x30"x10' NEWTON Horizontal Spindle Slab Miller with adjustable rail, table 27"x11'. AC or DC motor drive.

24"x36"x12' INGERSOLL Planer Type side milling machine with two power feed heads on housings for side milling only.

24"x24"x12' INGERSOLL Planer Type milling machine with one head on adjustable rail and two side heads, AC or DC motor drive.

42"x26"x12' Ingersoll Planer Type milling machine with two heads on adjustable rail & two side heads. AC, DC.

PLANERS

36"x36"x14' PUTNAM Heavy Planer with two heads on rail. 230 Volt DC reversing type planer motor and control.

38"x38"x14' OHIO Heavy with two heads on rail and one side head. 230V DC reversing type planer motor and control.

48"x48"x16' NILES - BEMENT - POND Heavy with two heads on rail and two side heads. 230V DC reversing type planer motor and control.

48"x48"x18' G.A. GRAY Spiral Drive with two heads on rail and one side head. AC motor drive with self-contained countershaft.

48"x48"x24' NILES - BEMENT - POND Heavy with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

48"x48"x32' G. A. GRAY Spiral Drive with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

48"x48"x24' NILES - BEMENT - POND Heavy with two heads on rail and one side head. AC motor drive through self-contained countershaft.

48"x48"x20' F. R. PATCH Heavy with two heads on rail and two side heads. 230V DC reversing type motor and control.

60"x48"x18' G. A. GRAY widened Spiral Drive with two heads on rail and one side head. AC motor drive.

60"x60"x12' NILES - BEMENT - POND Heavy two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

72"x72"x18' NILES - BEMENT - POND Heavy, two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

72"x72"x20' NILES - BEMENT - POND Extra Heavy, two heads on rail and two side heads, 230 Volt DC reversing type planer motor and control.

84" WIDENED TO 98"x32"x42' SOUTHWARK Extra Heavy, two rail heads and two side heads. 230 Volt DC reversing type planer motor and control.

16'x10'x30' BETTS heavy, two heads on rail and two side heads, forced feed lubrication. 230 Volt DC reversing type planer motor and control.

SLOTTERS

12" SELLERS Crank Slotter, 32" circular table, AC or DC motor drive.

15" NEWTON Crank Slotter, 30" circular table, AC or DC motor drive.

15" NILES-BEMENT-POND, 30" circular table, AC or DC motor drive.

20" SELLERS Crank Slotter, 48" circular table, AC or DC motor drive.

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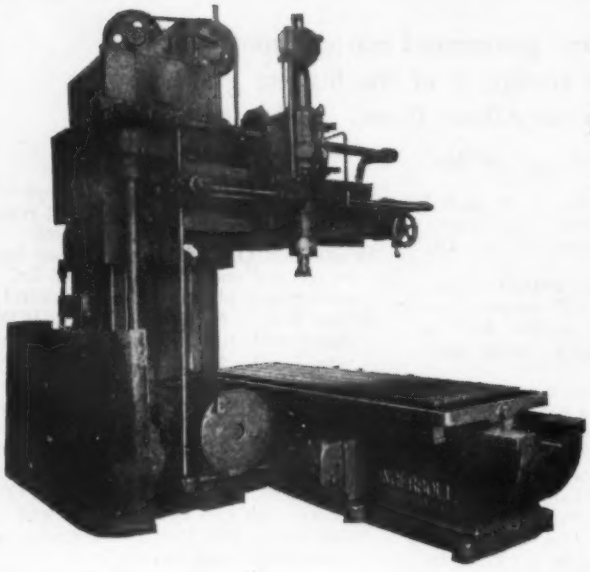
NEW YORK OFFICE: 50 EAST 42nd STREET, NEW YORK 17, N. Y.

INGERSOLL OPEN SIDE VERTICAL MILLER



30"x48"x96" INGERSOLL OPEN SIDE VERTICAL MILLING MACHINE

Table working surface 29" x 96".
Spindle vertical feed 24".
Table travel 96".
Maximum distance spindle to column 44".
Adjustable rail.
Power rapid traverse.
Arranged for motor drive.
Weight about 24,000 lbs.

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This machine is available for inspection at any time.

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Drill, two-spindle sensitive, #1 Morse taper
Drill, 4-spindle sensitive
Gear cutter, Brown & Sharpe #3—26
Gear cutter, Gould & Eberhardt 42"
Grinder, Webster and Perks #1-¾ motor drive.
Hammer, 50# Bradley upright helve.
Two 18"x8' Mueller lathes, H.S. quick change gear
One 16"x6' Hendey Lathe.
Pipe Machine, 8" Oster motor drive
Planer 24"x24"x6' Pease, motor drive
Punch & Shear two ½" & ⅝" capacity
Shaper 24" Gould & Eberhardt
Shaper, 16" Barker
Threading Machine #0 Webster & Perks
Tool Grinder Sellers new #0, #1 and #2 magic chuck and collets

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200 H.P. Hor. 4 Pl. Motor Driven Pump, Capacity 78 G.P.M. 4000#
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18"x15' Accumulator 1500#
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SALE
MORE THAN 1200 STANDARD GENERAL PURPOSE
MACHINE TOOLS
(TOGETHER WITH A LIMITED QUANTITY OF SPECIAL PURPOSE TOOLS)
By the Reconstruction Finance Corporation
at the Studebaker Plant—Chicago, Illinois.
Inspection Oct. 1st through Oct. 12, 1945 (Except Sunday)

The entire quantity of machine tools used for precise, close limit manufacturing in one of the nation's largest aircraft motor plants will be offered for sale during October by the Reconstruction Finance Corporation.

Approximately 95% of these tools are standard general-purpose machines. All are used. Their condition can be judged from the fact that all have been built since 1941. Many of them, however, did not go into production until early in 1942 and all were operated with proper maintenance and care until production was discontinued last June. All are of modern design.

Machines have been left in their original production lines for your inspection anytime between 9 A.M. and 4 P.M. from October 1 to 12, 1945 (except Sunday). Each machine is complete with motors and starters for three-phase, 60-cycle, 220/440-volt, AC service.

All standard general-purpose machines will be priced on the Clayton Formula.

In addition to the standard machine tools, there is also a limited quantity of special purpose tools for which you may find a use. Some of these special tools may be converted for standard use.

Plan now to visit the Studebaker Plant, Chicago, Illinois, any day except Sunday between October 1 and 12, 1945, and inspect these machines.

Submit your offer to purchase not later than 3 P.M., October 16, 1945. In case duplicate offers to purchase are received, the purchaser will be determined by lot.

For additional information about this sale, communicate with the nearest RFC office listed below. For a complete list of the equipment included in this sale ask for a copy of special listing number 25, which will be published on or about September 15, 1945.

Note: All equipment included in this sale is subject to withdrawal.

MACHINE TOOLS INCLUDE:

Turret Lathes
Radial Drills
Automatic Screw Machines
Grinding Machinery (all types)
Milling Machines
Vertical Drilling Machines

ADDITIONAL EQUIPMENT INCLUDES:

(The Clayton Formula Does Not Apply to the Following)
Heat-Treating Furnaces
Plating Equipment
Anodizing Equipment
Dichromate Equipment
Impregnating Equipment for Magnesium Castings
Conveyer Equipment
Paint Spray Equipment
Drying Ovens

Offers to purchase Non-Clayton Formula items will be received up to 3 P.M., October 16, 1945. The RFC reserves the right to reject any or all offers.

WHERE TO INSPECT EQUIPMENT:

Studebaker Plant—5555 South Archer Avenue, Chicago, Illinois
October 1 through October 12, 1945 (Except Sunday).
Inspection Hours 9 A.M. to 4 P.M.

RECONSTRUCTION FINANCE CORPORATION

CH2-1

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AUTOMATICS, Cone, 1¼, 2½ & 3½" 4 spdle
CONOMATIC, 1⅞—6 spindle, M.D.
AUTOMATICS, Gridley, ¾, 1¾, 1⅞, 2¼" & 2⅝" Model F, M.D.
AUTOMATICS, Gridley, 2¼, 3¼, & 5¼" B. B.
AUTOMATICS, Cleveland 1¼, 1½, 2, 2½, 3½ & 4¾" Model A, M.D.
AUTOMATICS, Cleveland, ¾, 1¼, & 2" Mod. B
AUTOMATICS, New Britain #22 and 24 Chuckers
AUTOMATICS, New Britain, ⅝ & 3¾" & 1x5" M.D., Bar Eqpt.
AUTOMATICS, Potter & Johnston #5a & 6a, M.D.
BORING MILLS, 30" Bullard, M.D.
BORING MILLS, Rockford, 3½" bar, Horizontal, 24x72" table, M.D. & 3½" Universal, M.D.
DRILLS, High Speed, B. B. 1 to 6 spindles
GEAR HOBBERS, 12 Barber-Colman, M.D.
GEAR SHAPERS, #7 High Speed, M.D. & #6
GENERATOR, Gleason Spiral Bevel Gear, 10"
GRINDERS, Brown & Sharpe #2 & 3 Universal
GRINDER, Brown & Sharpe #11 Plain, M.D.
GRINDER, Heald #72 Hydraulic, 2 M.D.
GRINDERS, Bryant #3, 6 & 18 Internal, M.D.
GRINDERS, Diamond Surface #2, M.D.
GRINDERS, Landis Hydraulic, 6x18" M.D.
GRINDERS, Pratt & Whitney, 12" Vertical Surface, M.D., 9x31", Magnetic Chuck
LATHES, American 14x6' & 20"x8', M.D.
LATHES, Lodge & S, 20"x10' Geared Head, M.D.
MILLING MACHINES, #2 B Hvy. B&S Plain
MILLING MACHINES, Becker Vertical #5 & 6
MILLING MACHINE, Milwaukee #1B Plain & Universal #3B Plain, M.D.
MILLING MACHINES, #2 B Rockford Universal
PLANER, Gray 30"x30"x3' 2 Rail Heads
PLANER, Ohio 42"x42"x12' One Head, M.D.
PLANER-SHAPER, 30" Cincinnati, M.D.

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2-L Gisholt Universal Turret Lathe
#2 Cincinnati Centerless Grinder, 1940
8" x 48" Jones & Lamson Automatic Thread Grinder, 1940
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5" Bar Newark Horizontal Boring Mill, 8' Bed, M.D., $2250.00
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16" 8-sp. Bullard Mult-Au-Matics, 2 yrs. old
B & S Surface Grinders 2 yrs. old
#40 Cross Gear Tooth Rounder, M.D.
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10x36 Norton Hydraulic Grinder, 1 yr. old

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Testing Machine, 10,000# Olsen Univ.
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30"x26' Lodge & Shipley 12 speed Geared Head, M.D.
32"x35' Wickes Grd. Hd., M.D.
36"x30' Putnam Grd. Hd., M.D.
42"x16' Putnam, M.D.
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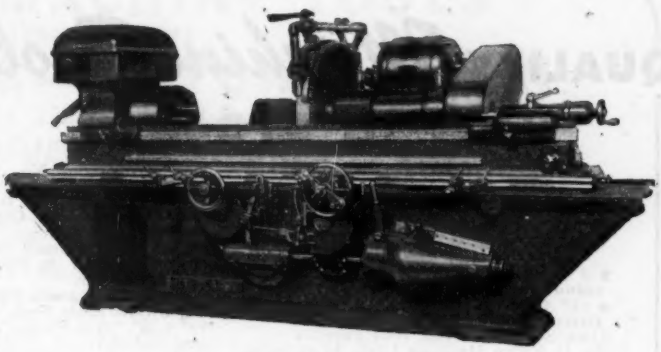

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10x50	14x72	18x96
10x72	14x96	18x120
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GISHOLT 42" Vert.—2 heads
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NATCO D-5 High Speed Multiple

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¾" Cleveland Model M, four spindle.
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No. 5A and No. 6A Potter & Johnston.
No. 2, 4, 6, Warner & Swasey, c.d.
★ 42" Bullard VTL, New Era type.

MILLS
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No. 4 LeBlonde Plain, c.d.
★ No. 2 Milwaukee Plain, double overarm, motor in base.
No. 1A Milwaukee Plain, s.p.d.
★ No. MM5 U. S. Multimiller, motor in base.
18" Cincinnati Plain Mfg., s.p.d.
24" x 24" x 16' Ingersoll Rail Type.
★ No. 4 Cincinnati Vertical, s.p.d.
No. 2 Milwaukee Vertical, motor in base.
No. 0-8 Cincinnati Vertical, m.d.
★ 3" Universal Horizontal Boring, m.d.
6" x 14", 6" x 48", P. & W. Thread Mill.
4" Pratt & Whitney Spline Mill.

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36" x 36" x 12' Woodward & Powell Planer, 2 heads.
24" x 24" x 8' American Planer, one head.
20" American Crank Shaper, s.p.d.
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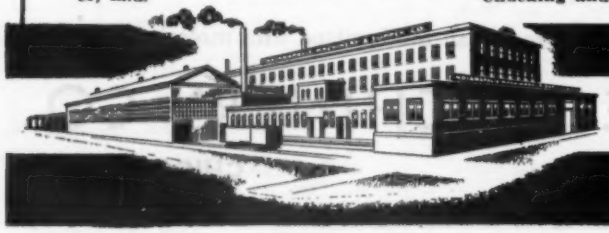
★ No. 6 Marvel Hack Saw, cabinet base with tank.



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26"x14' Maine Engine Lathe, quick change, compound rest $1200
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#3 B&S Plain Miller, Ser. #1434, Taper nose spindle.....$700
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3½' Bickford Radial Drill, cone drive $400

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1—#00 B. & S. Automatic
1—#0 B. & S. Automatic

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1—Bath Universal, counter shaft drive
1—1¼" Oliver Drill Grinder, M.D.

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16"x8' Lodge & Shipley, Q.C.G. Taper Att.
11"x4' Sheldon, Q.C.G.

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4—6 spindle Allen 8" High Speed #2 Morse Taper
3—3 spindle Allen 8" High Speed #2 Morse Taper

MILLS
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1—#2 Rockford Universal Cone Drive

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#7 Long & Allstatter Sprue Cutter
24"x24"x6' Ohio Planer. Arranged for motor dr.
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2—1"x18" Pratt & Whitney Automatic.
1—8" Sunstrand Stub Lathe M.D.

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SUITABLE for 1", 1½" and 2" CAPACITY TURRET LATHES
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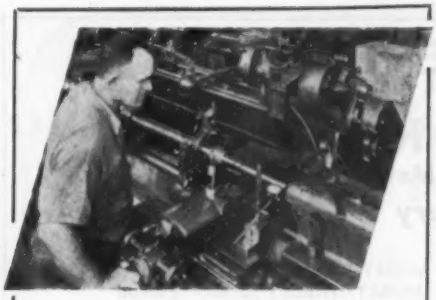

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Acme 3¼" M.D.

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P & J. 6A, M.D.
⅞" Cone 4 spindle

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B. & S. No. 3-26", 4-36"
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16", 20", 26", Stockbridge
20", 24" G. & E., M.D.

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Providence Planer Type 32"x8'
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Nos. 3, 4, Cincinnati Vert.
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K. & T., B. & S. No. 2, 3 Dbl. overarm
B. & S. No. 2, 3, Vert.
Milwaukee No. 2½ B Vert.
Kempsmith No. 1 Univ.

MISCELLANEOUS

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6 spindle Avey Drill, 15" overhang
McCabe ½" Flanger
Rochester No. 5½ B Hammer
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No. 2½B Milwaukee vertical.
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No. 3 Sundstrand Regidmil.
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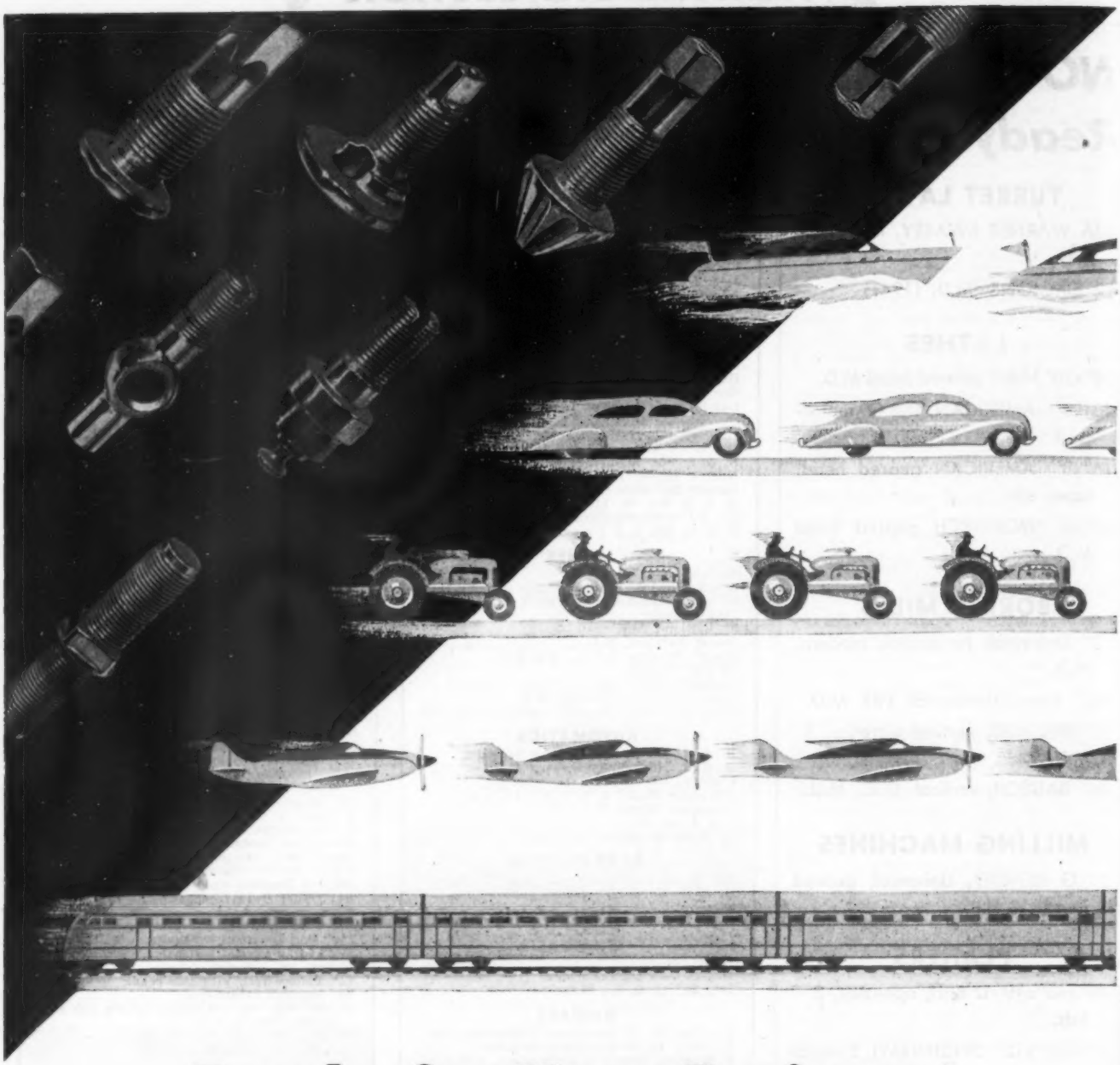

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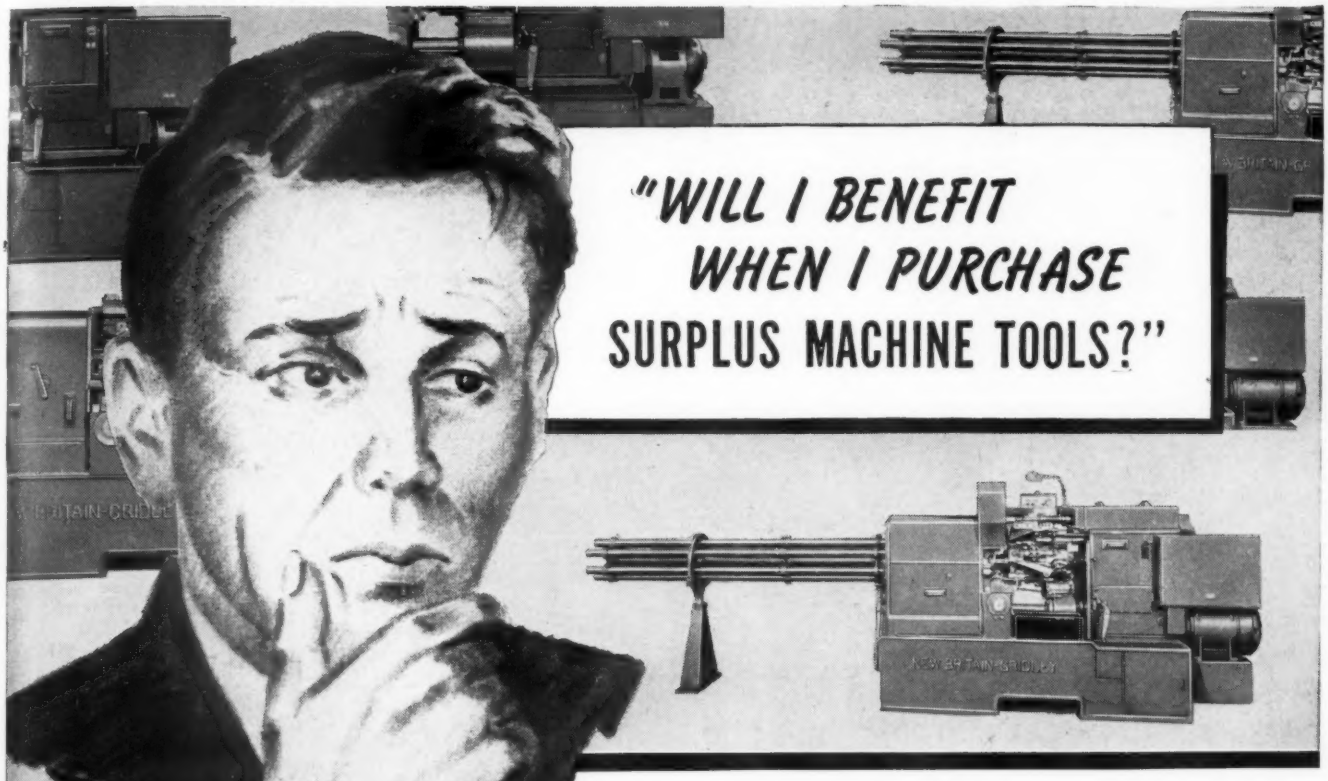

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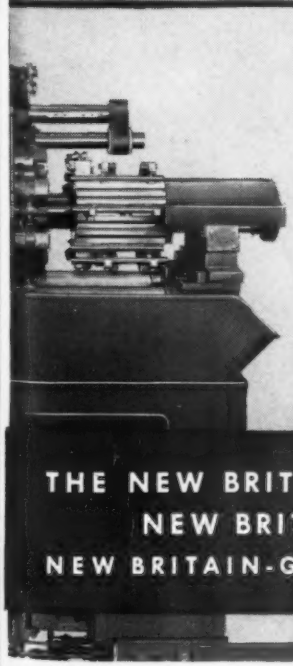
The ability of surplus New Britain-Gridley bar and chucking machines to continue to provide fast, accurate and economical peacetime production will be guided largely through intelligent redistribution and conversion. Let us help you. Consult with our nearby Sales-Engineer or, should you prefer, communicate direct.



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NEW BRITAIN-GRIDLEY MACHINE DIVISION

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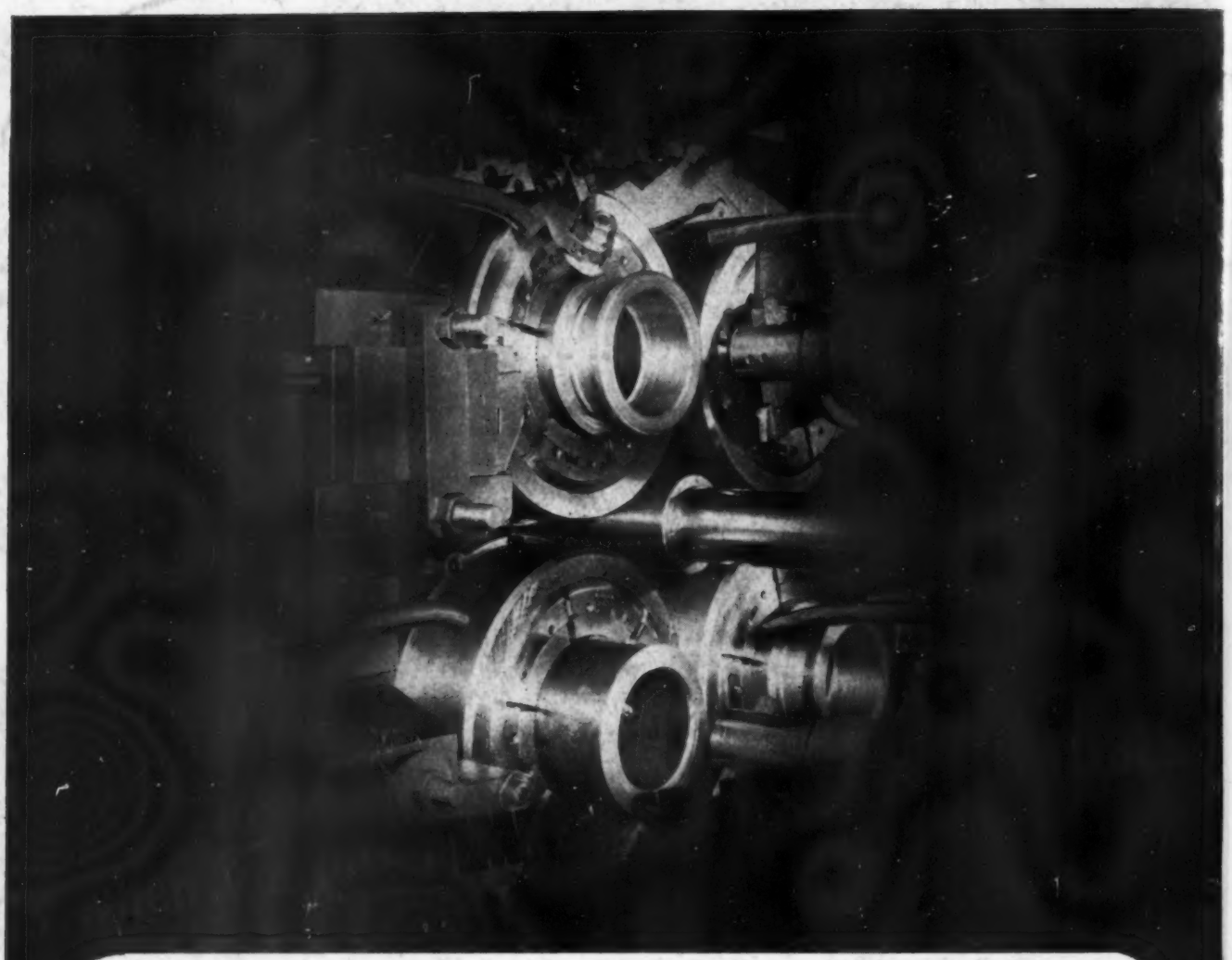

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